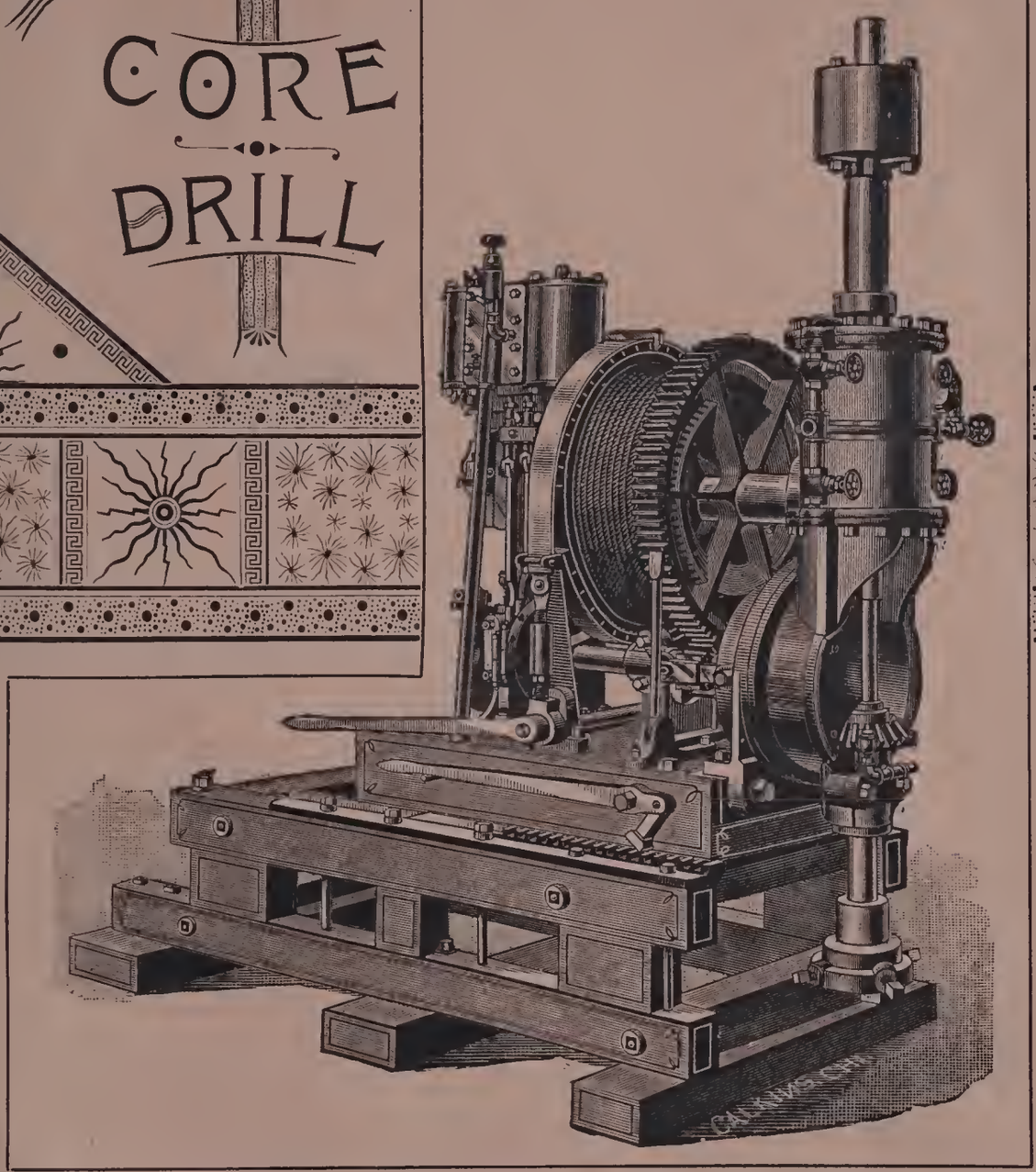
THE SULLIVAN DIAMOND PROSPECTING CORE DRILL



SIMPSON & WATKINS,

AGENTS FOR PENNSYLVANIA,

SCRANTON, · PA.

MCCLUER PRINTING CO., 53 DEARBORN ST., CHICAGO.

Diamond Prospecting Company, Limited.

CATALOGUE

. . . OF . . .

SULLIVAN DIAMOND PROSPECTING CORE DRILLS

. . . AND . . .

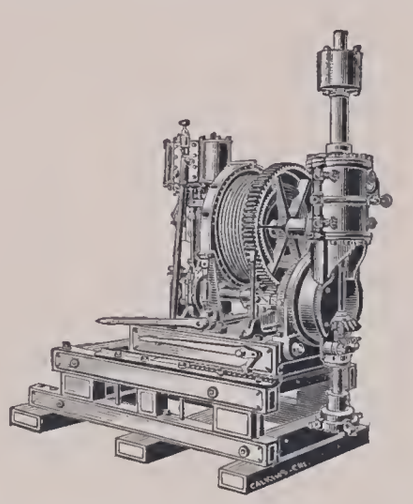
ROCK DRILLING TOOLS AND SUPPLIES.

DIAMOND DRILLS

ADAPTED TO

ALL KINDS OF DRILLING,

GIVING PERFECTLY RELIABLE AND SATISFACTORY RESULTS.



HOLES BORED

STRAIGHT AND ROUND

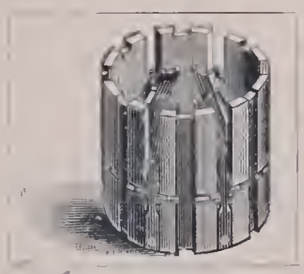
OF ANY SIZE

AND

TO ANY DEPTH,

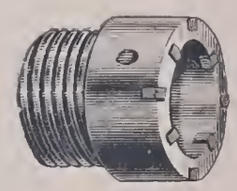
REMOVING A

SOLID SECTION OF ROCK.



HAND DRILLS.

POWER DRILLS.



PROSPECTING FROM THE SURFACE OR UNDERGROUND.

CONTRACT PROSPECTING A SPECIALTY.

SIMPSON & WATKINS,

AGENTS FOR PENNSYLVANIA,

SCRANTON, PA.

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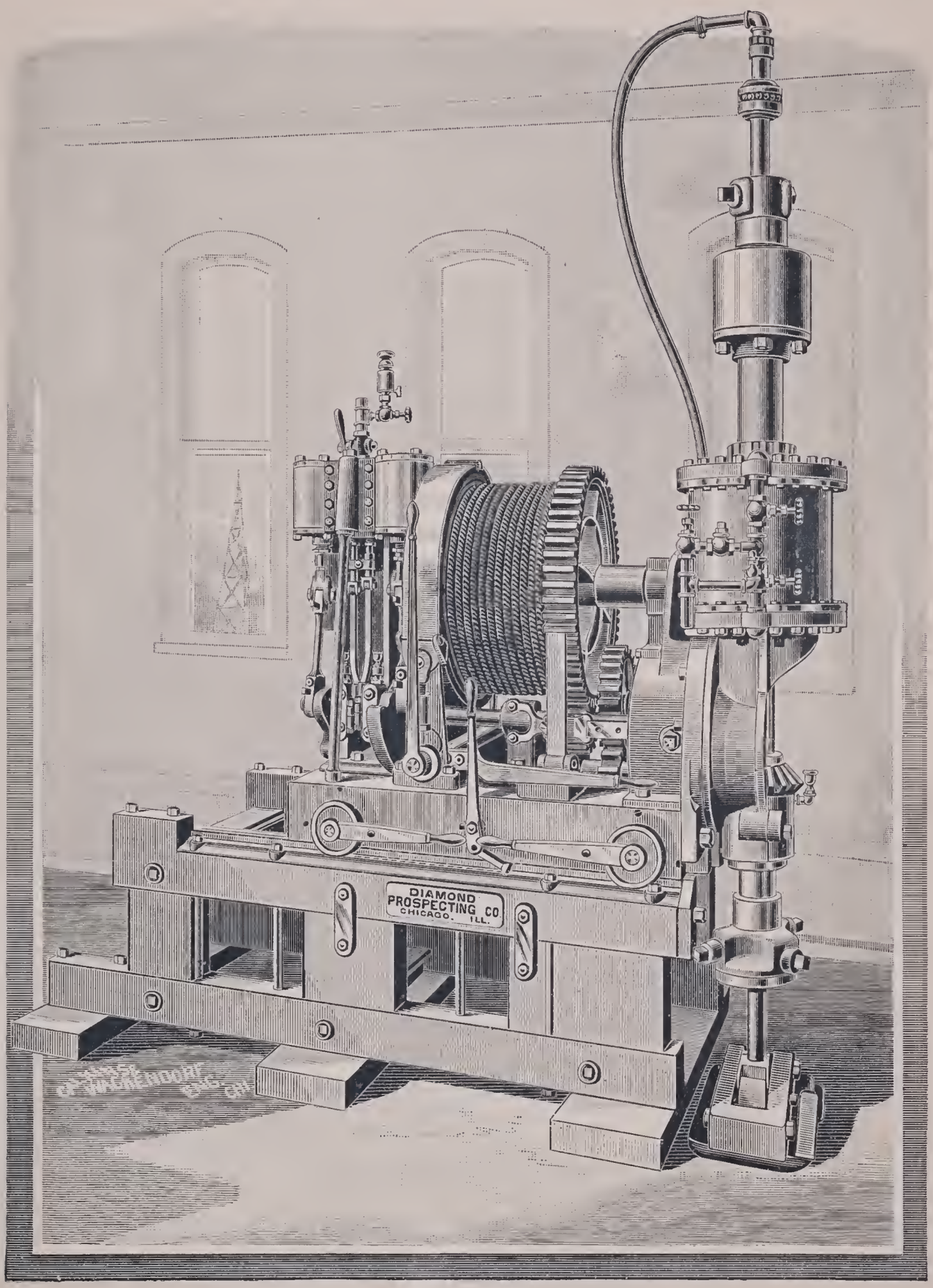


DIAMOND PROSPECTING CO.,

74 AND 76 WEST LAKE ST., - - - - - CHICAGO, ILL.

DIAMOND
PROSPECTING CO.
CHICAGO, ILL.

OFFICE OF

DIAMOND PROSPECTING CO.

74 & 76 WEST LAKE STREET.

CHICAGO, ILL., FEBRUARY 1, 1889.

IN presenting this new Catalogue of the SULLIVAN DIAMOND DRILLS and of ROCK DRILLING TOOLS AND SUPPLIES, we beg leave to call attention to a number of improvements and new designs. By our long experience in the sale of these machines and in their use for contract prospecting, we have become familiar with all the requirements of Diamond Drills for every class of work. The company manufacturing the Sullivan Drill has been engaged in the manufacture and operation of Diamond Rock Cutting and Boring Machinery since 1868, and their experience, combined with our own, has resulted in the improved forms of these Drills as now made.

The sale of the Sullivan Diamond Drill in all parts of the United States and in foreign countries proves the extent of its reputation; and our testimonial letters, some of which we publish in this Catalogue, show the satisfactory results which follow its use in all cases, and, we think, justify us in claiming that in economy and efficiency, workmanship, cost and all details of design, manufacture and operation, the Sullivan Diamond Drill is the best and most satisfactory made.

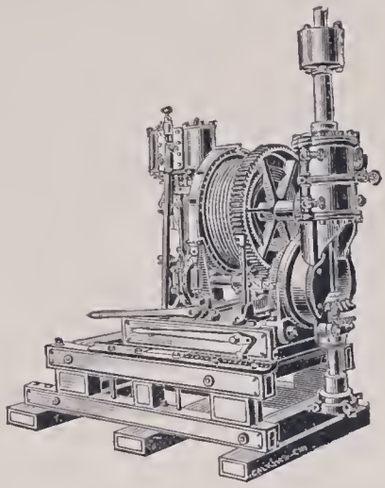
We carry all sizes of these Drills in stock, and can fill orders promptly. We have also a complete stock of our special tools and fittings.

We solicit correspondence in regard to Diamond Drills, Rock Drilling Tools and Supplies, and the prospecting of mineral lands by contract; submarine drilling; holes for ventilating and draining mines; drilling of artesian, oil, salt or gas wells; tests for bridge or other foundations; examination of the condition of masonry of bridge piers; and all work to which the Diamond Drill is applicable; also in regard to complete plants for hoisting and underground hauling, exploring hoists, steam pumps, boilers, air compressors, quarrying machinery, etc., etc.

DIAMOND PROSPECTING CO.

SIMPSON & WATKINS,
AGENTS FOR PENNSYLVANIA,
SCRANTON, PA.

The DIAMOND DRILL.



ITS ADVANTAGES OVER OTHER DRILLS.

IN the development of mineral property for coal or ore, one of the most important considerations is the preliminary "prospecting" by which the exact position, extent, thickness and value of the mineral deposits are ascertained. This is usually done by drilling holes from the surface, which is a quicker and cheaper method than drifting or sinking a shaft.

It is now a well-established fact that the only reliable and satisfactory way of drilling prospect holes is by means of the Diamond Core Drill. Other methods of prospecting, where the Churn Drill Process is used, are absolutely valueless, as far as reliable results are concerned. We can give many instances where sums of from one thousand to twenty-five thousand dollars have been thrown away in sinking shafts for coal on the records furnished by churn drills, the supposed vein of coal proving to be a black bituminous shale. It is impossible to determine accurately with the churn drill the difference between coal and black slate or shale if highly bituminous.

The Diamond Drill bores a perfectly straight, smooth hole to any depth or in any given direction from vertical to horizontal, bringing to the surface a solid section or "core" of every stratum passed through, in order, showing its exact depth, thickness and the character of the rock. This core is large enough to be thoroughly examined and tested; and what is of almost equal value, if the mineral sought for is absent, the fact is determined beyond a doubt. It also gives positive information of the material that would be met in sinking a shaft to work the mineral whose presence has been determined, making it possible to estimate the cost of the shaft closely.

The requirements of a machine for such work are many and exacting. It must be strong, simple and durable, economical in use of steam and in the wear of the diamond points or "carbon," rapid in operation, and above all, its work must be accurate and reliable, so that the results derived from it will be known to be correct, as upon them depends the expensive process of sinking shafts and driving tunnels, as well as the investment of large sums of money in land.

Not only for prospecting from the surface, but for drilling in advance of levels underground; for sinking wells for gas, oil or water, especially where coal, salt or other minerals are also looked for; in submarine work, stone quarrying and for many other special purposes, the Diamond Drill is far superior to any other. Consequently, it is coming into general use, and is considered essential to the economical development of mineral lands, as possessing great advantages in time, accuracy and economy over any other method of prospecting.

GENERAL FEATURES

OF THE

SULLIVAN DIAMOND PROSPECTING CORE DRILL.

THE SULLIVAN DRILL fulfills all the requirements necessary for a Diamond Drill of the best design and for the most efficient service. It possesses the most improved features of machines of this kind, many of them peculiar to itself, and the result of much observation and experience in practical work.

Each machine, except in case of the smaller sizes, consists of three parts—the engines, the hoisting and the feed apparatus. These parts, although comprised in one machine, are yet distinct, and each can be operated independently of the others. They are mounted on a cast-iron base-plate, which rests on a bolted and braced hardwood frame. The base-plate slides back and forth on ways on the frame, moved by a hand lever working in a rack on the frame. By moving the drill back in this way it is got out of the way of the rods while pulling up and lowering.

ENGINES. The engines were designed especially for these machines, with a view to simplicity, compactness and economy. They are vertical, two in number, set quartering, and can be driven by steam or compressed air. Their special feature is in the proportioning and adjustment of the valves, which ride upon each other between the cylinders, interact on each other in admitting and cutting off the steam, and are thereby balanced. This arrangement allows great compactness of the engines, an unusually quick opening and closing of the cylinder ports, and produces a correct distribution of the steam for economy and smooth running. These engines are provided with a relief drip valve, by which all water can be drained from the steam pipes without entering the steam chest or cylinder, and with petcocks for draining the latter after steam is admitted to them.

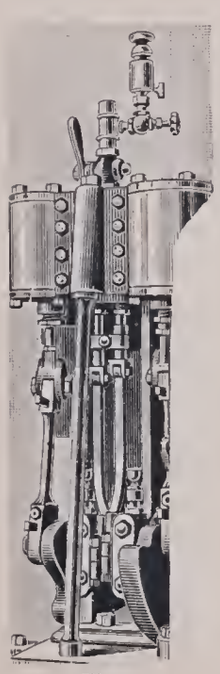


Fig. 1.
Engines.

The "E" drill is driven by a single engine, well balanced and adapted to steam or compressed air.

The wearing parts of all the engines are few, and provided with ample means of lubrication and adjustment; so that repairs are not frequent. When necessary, they can be made by any intelligent engineer or machinist; the drill runner, with a portable forge and the tools usually found in a drill outfit, can make all ordinary repairs.

HOIST. The hoisting apparatus in the larger machines consists of an iron drum, wound with wire rope, and with suitable combinations of gearing for hoist-

ing the full weight of rods from any ordinary depth without the necessity of using double blocks. The drum is controlled by means of a powerful wood-lined brake, operated by a hand-lever and screw or cam, and adjustable for wear. The hoisting gears are disconnected while not in use for hoisting, to avoid unnecessary wear. In the "M" Hand Drill and the "E" Drill for underground prospecting, the rods are raised by hand power, with rope and blocks. When the "E" drill is used for surface work, it is fastened to a frame provided with drum and gearing, and the rods hoisted by crank power.

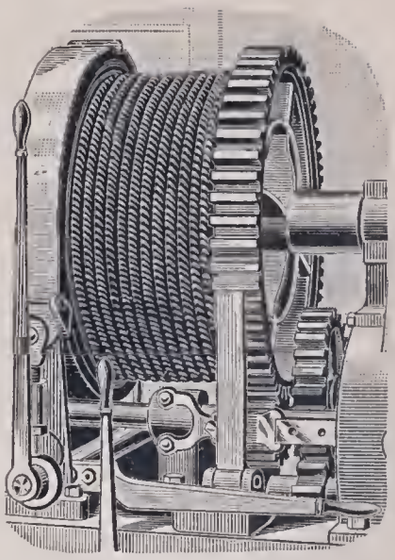


Fig. 2. Hoisting Drum "P" Drill.

HYDRAULIC FEED. For the advance or "feed" of the drilling bit, the *Single Cylinder Hydraulic Piston* Feed is used on all SULLIVAN DRILLS except in case of the "M" and "E" drills, whose friction feed will be described later. With the hydraulic cylinder the feed is not limited to three or four speeds, as in the case of the positive gear-fed drills, but can be adjusted to any degree of nicety necessary to secure the best results in speed and accuracy. Referring to the sectional view of the feed apparatus (Fig. 4), it will be seen that its arrangement and operation are as follows:

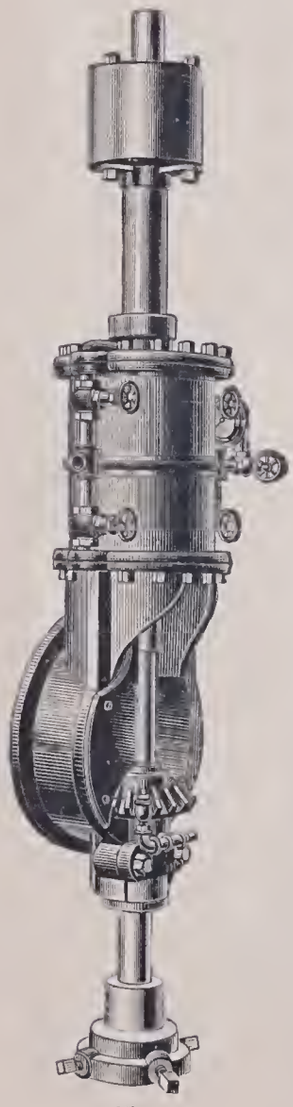


Fig. 3.
Hydraulic Apparatus.

A is the hydraulic cylinder, in which the piston *B*, moves up and down, attached to the piston-rod *C*, which moves with it. Connection to the pump is made at the tee *D*, and to the escape at the tee *E*, the water being let in and out through brass tubes *F*, and ports cast in the cylinder heads. Valves 1 and 2 are the "inlet" valves, and 3 and 4 the "outlet" valves. When 1 and 3 are open and 2 and 4 closed, water is pumped in above the piston and allowed to escape from below it, and the piston moves downward; when 2 and 4 are open and 1 and 3 closed, the reverse is the case, and the piston moves upward.

To the upper end of the piston-rod is screwed the thrust plate *G*, through which pass three studs screwed into another thrust plate *H*. Between the thrust plates are two sets of friction ball roller bearings, one set on each side of collar *I* on the drive-rod *J*. This collar transmits the vertical motion of the hydraulic piston to the drilling bit; for as the piston and piston-rod descend they carry with them the two thrust-plates *G* and *H*, and the two roller-bearings with the collar between them. The collar is screwed fast to the drive-rod *J*, and rotates with it, the rod being turned by the mitre gear *K*, which is driven by a similar mitre gear on the engine shaft. The piston-rod and drive-rod, then, descend together, the latter rotating within the former.

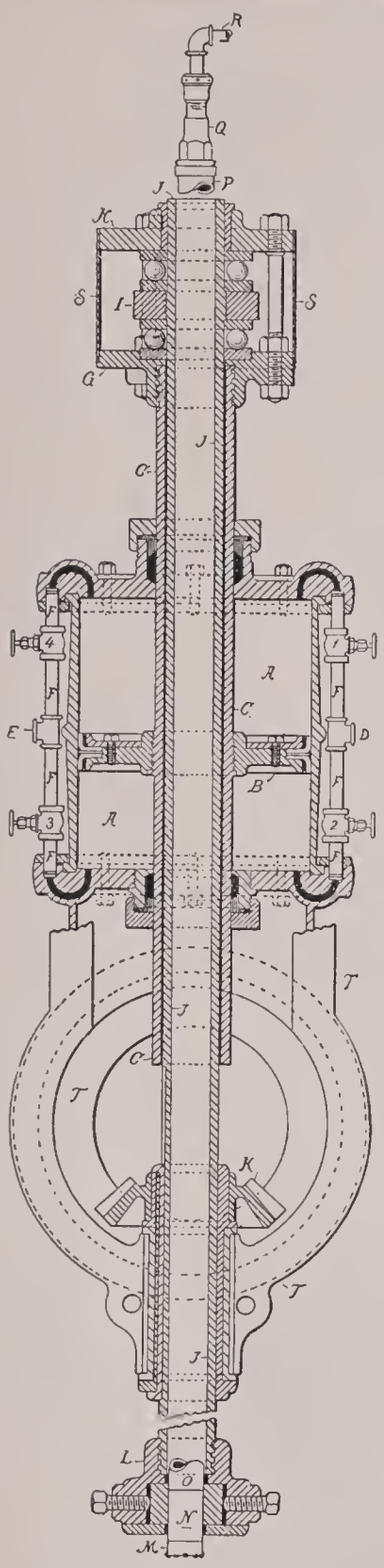


Fig. 4.
Section of Hydraulic Feed Apparatus.

Now the drill-rods, at the lower end of which is the drilling bit, pass through the drive-rod, and are held up and turned by means of a chuck *L*, screwed to the bottom of drive-rod. Therefore, as the engine runs, turning the mitre gear and drive-rod, the latter rotates within the hydraulic piston-rod and descends with it, sliding through the mitre gear, whose splines slide in grooves in the drive-rod; and the drive-rod, descending, carries with it the chuck, drill-rods and drilling bit. Thus by admitting water, under pressure, to one side of the hydraulic piston, and releasing it from the other side, the piston can be moved either up or down, the downward or advance movement being called "Feed."

ADVANTAGES OF HYDRAULIC FEED. The advantages of the hydraulic feed are many, for economy of time and saving of diamonds, and for great accuracy and safety in operation. The amount of water admitted to or released from the hydraulic cylinder can be varied to any degree by simply adjusting the inlet and outlet valves; and as the feed depends directly upon that amount, it follows that the feed can be adjusted with the greatest nicety. This unlimited range of feed is of the greatest importance, as by its means the operator, noticing at once any change in the hardness of the rock, shown by the gauges on the hydraulic cylinder, and indicated by the running of the drill, can immediately change the feed to exactly suit the new stratum penetrated; and in entering softer rock, can take advantage of a faster feed, if only for a few inches. Thus he is enabled to use skill and judgment to secure the most rapid and satisfactory progress.

The fact that the feed apparatus is entirely independent of the engines adds another element of economy to the SULLIVAN DRILLS, as the feed can be increased, diminished, or *reversed* while the drill is running, without loss of time. This fact adds also to the safe running of the machine, as in case of threatened wedging of the bit, it is a great advantage to *keep the rods turning*, at the same time stopping or reversing the feed until the bit cuts clear.

The hydraulic feed, operated by a *constant pressure* rather than a *constant rate of advance*, allows the drill to run with slightly slower feed on suddenly entering hard rock, when the runner can at once give the amount of feed the machine will take without injury to the diamonds. Thus the hydraulic feed avoids the shocks and jars, and consequent danger of breaking or wrenching out diamonds when drilling in rocks of different degrees of hardness, none of which can be avoided in drills using the "positive" gear feed.

NO DROP OF DRILL-RODS. As the water escaping from below the feed piston is throttled by the outlet valves while feeding down, and led up above the level of bottom of piston, it follows that the water cannot escape from bottom of cylinder faster than it enters at the top. Hence the lower part of the cylinder is *always full of water*, and in case a cavity is struck, the weight of the drill-rods, hanging on the piston, is supported by this body of water, which is *incompressible*, and *prevents entirely the dropping of the rods.* When a cavity is struck, the hydraulic feed continues downward as regularly as in drilling through hard rock.

ADVANTAGE OF SINGLE CYLINDER. By the use of a single cylinder with drill-rods passing through its centre, the line of pressure is always kept directly in the line of drill-rods, avoiding cross strains and reducing friction.

INDICATING GAUGES. The SULLIVAN DRILLS are provided with gauges which indicate at once the pressure on the bit and condition of the core. This prevents grinding away the core, and at once indicates to the runner any change in the formation.

FRICTION ROLLER BEARINGS. An important detail of the hydraulic feed-drills is the friction roller bearing, shown in Fig. 4 and in the accompanying perspective view, Fig. 5. It consists of two sets of hardened steel balls, ground round and true, which run in grooves in steel plates, also hardened and ground. One set sustains the weight of the rods when they hang in the drill-chuck; the other set sustains the upward thrust of the rods in drilling. This device reduces to a minimum the amount of work lost in friction, leaving the whole power of the engines to be devoted to drilling. The friction roller bearing is enclosed in a sheath which keeps it clean and prevents heating.

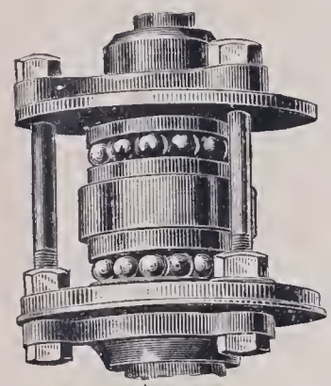


Fig. 5.
Friction Ball Roller Bearing.

FRICTION FEED.—As the hydraulic feed is not applicable to the smaller machines, another form has been used in their design. It is a friction feed, not hitherto applied to rock drills, which consists of a system of differential gearing, driven by *friction*, instead of being "positive." The driving power from drill-spindle to countershaft is transmitted through leather washers on either side of the loose upper countershaft gear. In feeding, the gear and washers are pressed against a collar below them on the countershaft, by tightening a compression spring. This spring is coiled in a sleeve, which is keyed to the countershaft above the upper gear. When the spring is compressed, the countershaft revolves with the upper gear and washers, at a speed determined by the amount of compression, the lower countershaft gear turning the feed nut gear; and as the amount of compression of the spring, and consequently the friction of the washers, can be increased or diminished at will, it follows that the feed can be varied up to any limit fixed by the proportions of the feed gears.

This feed has drilled many thousand feet in jasper, quartzite and gneiss, as well as in soft formations, with very satisfactory results; for the "friction" element of this arrangement, like the hydraulic feed of the larger SULLIVAN DRILLS, allows the same careful regulation of the feed, to secure the best results in all kinds of rock without danger to the diamonds.

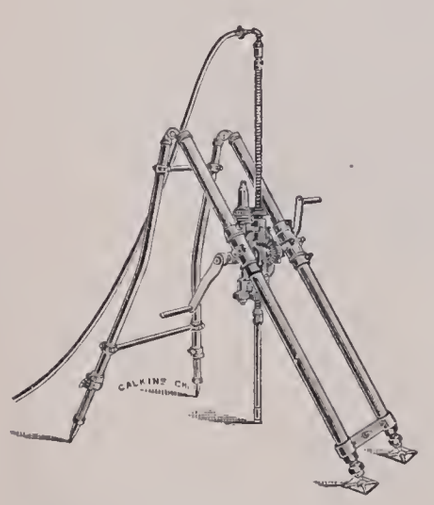
SIMPLICITY OF DESIGN.—In designing and building these machines, it

has been the aim to make them simple, and of strong, durable material, with all parts easily accessible. This is especially necessary in machines of this character, which are frequently subjected to rough usage in mines, backwoods or mountainous country, in remote places, where any break-down might entail great loss of time. As, however, an occasional mishap can not be avoided, all parts of these Drills are made to gauge, by jigs and templates, and hence are interchangeable. The parts most liable to need replacing are kept in stock at store or factory, and any piece can be forwarded at once on receipt of telegraphic order.

NO RESTRICTIONS AS TO USE.—When Diamond Drills were first built for prospecting work, their sale was controlled by a few persons having a monopoly of all important Diamond Drill patents then in existence, and the purchaser was put under numerous restrictions as to the use of his machine. Some manufacturers of Diamond drills attempt to impose these restrictions even now, the recent catalogue of one company stating that the regular prices named, "give purchasers the right to use for prospecting purposes, or shafting, only on property owned or worked by them under a *bona fide* mining lease; and for blasting purposes, only upon contracts in which they have a *bona fide* interest. Where a more extended license is required it must be obtained by special contract."

The Sullivan Drill was the first Diamond Drill sold *absolutely without restrictions*. It has been so sold ever since its first appearance on the market. Any one buying a Sullivan Diamond Drill has perfect liberty to use it as he would any other piece of property. He can use it when and where he likes, for his own work, or under contract to work for others, and can lease or sell it if he so desires.

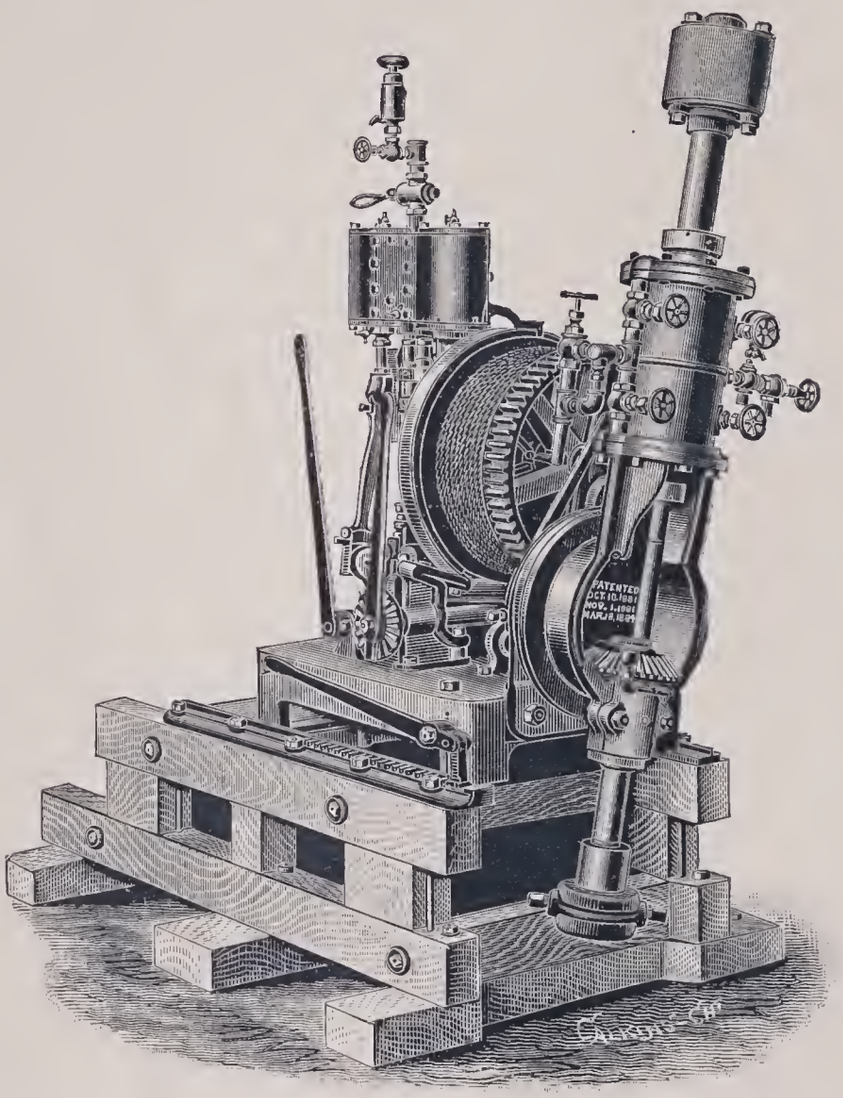
The **SKILL REQUIRED TO OPERATE** the Sullivan Diamond Prospecting Drills is not unusual in amount. Any man of ordinary intelligence, with a fair knowledge of engines and machinery and rock formations, can run one of these drills for ordinary prospecting. For deep drilling, it is well for the man in charge to have had the experience that comes from ordinary prospecting, in order that he may be prepared for any contingencies that may arise. In all cases where a machine is sent out to be used by those unfamiliar with Diamond Drills, we *recommend* the purchaser to engage an experienced operator, whom we can always provide, to take charge of the drill for a *few weeks* only, to instruct the purchaser's operator thoroughly in the running of the machine and the setting of diamonds. This plan is always economical in the end; for, while the drills can be operated by those not familiar with them, as explained above, yet the knowledge gained from a competent instructor enables a new operator to make much more rapid progress, with less danger of accidents, than would be possible with a knowledge due to only a few weeks' personal experience.



Sullivan Hand-Power Diamond Drill.

With the above general description of the Sullivan Drill, and the details of each machine which follow, a good idea can be had of their qualifications for perfectly satisfactory work. We shall be glad to furnish any further information if it is desired.

SULLIVAN
DIAMOND PROSPECTING CORE DRILL.
SIZE "A"



CAPACITY, 1200 FEET DEPTH. DIAM. OF HOLE, 1 3-4 IN. DIAM. OF CORE, 1 3-16 IN.
(See Note 2 on page 24 in regard to increasing size of hole).

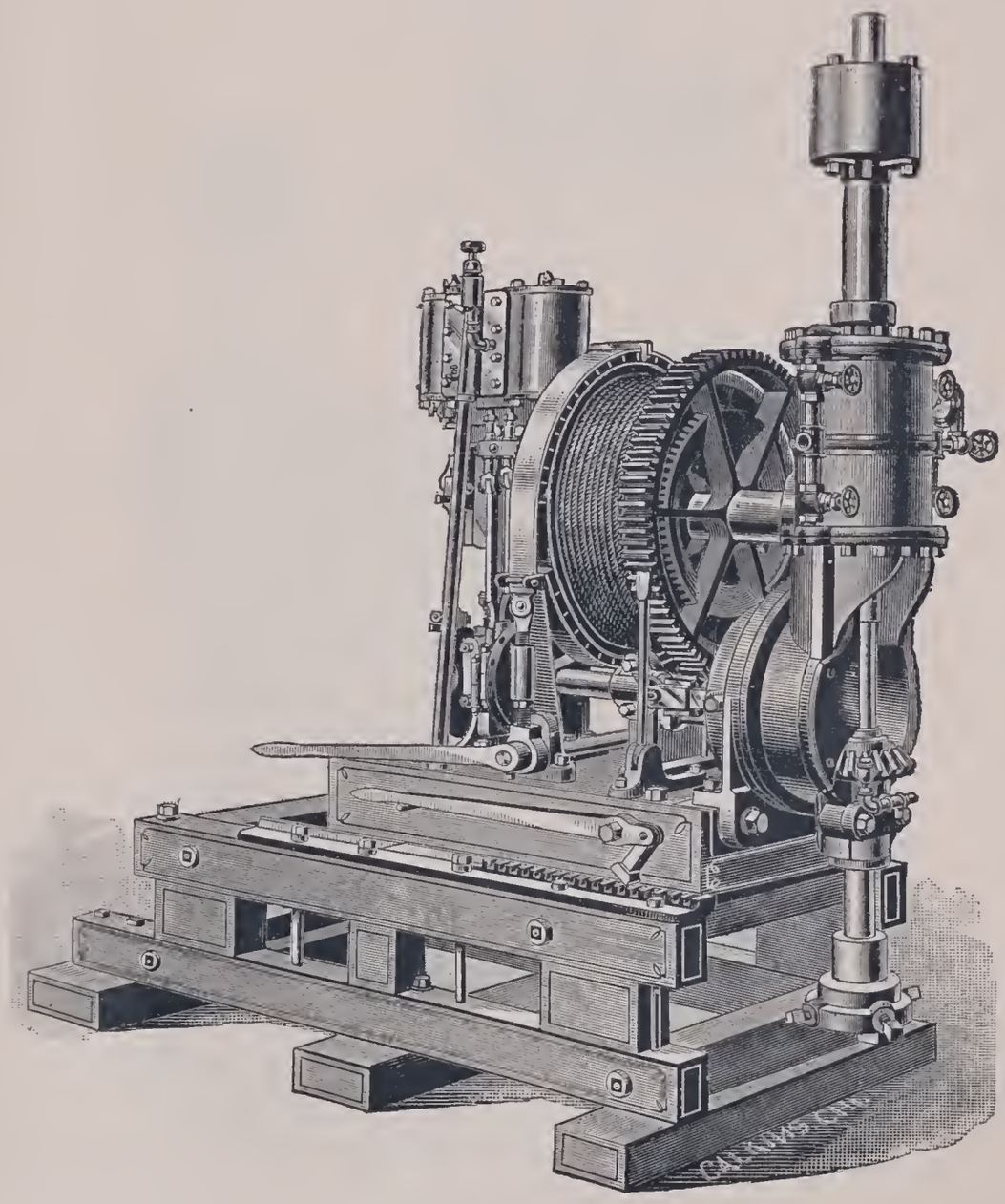
The cut shows the Cylinder and Drive-Rod set at an angle, by means of its swiveled connection to the Frame. In this way a hole can be drilled at any angle, from vertical to horizontal. This is invaluable for underground prospecting, and is sometimes necessary in surface work. All Sullivan Drills are swiveled in this way.

We have used "A" Drills for years in our own contract work, and have frequently drilled with them to a depth of 1100 or 1200 feet with the most satisfactory results.

For equipment furnished with the "A" Drill and included in the price, see page 22. For shipping weights and dimensions, see page 25.

SULLIVAN
DIAMOND PROSPECTING CORE DRILL.

SIZE "B."



CAPACITY, 3000 FEET DEPTH. DIAM. OF HOLE, 2 IN. DIAM. OF CORE, 1 3-8 IN.

The engines, hoisting rig and feed works of this machine are strongly built for deep work. The hoisting gears are proportioned for a heavy weight of rods, the drum making one revolution to 39 of the engine; while for less depths, a direct gearing in the ratio of 1 to 13, allows quick hoisting speed with light loads, one revolution of the drum winding up about six feet of the rope.

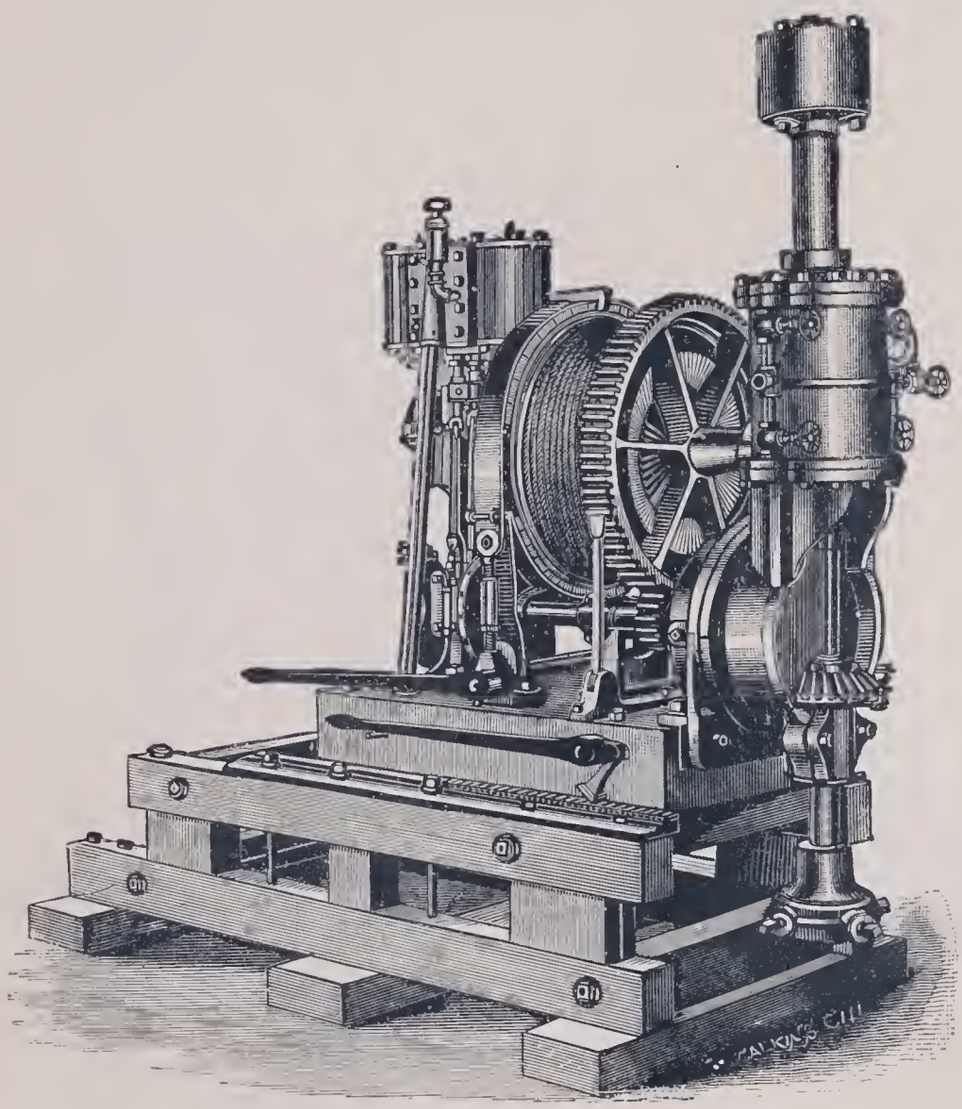
We have drilled with our "B" Drill to a depth of over 2,350 feet without counterbalancing the weight of drill-rods.

For equipment furnished with the "B" Drill and included in price, see page 22. For shipping weights and dimensions, see page 25.

SULLIVAN

DIAMOND PROSPECTING CORE DRILL.

SIZE "C."



CAPACITY, 1200 FEET DEPTH. DIAM. OF HOLE, 1 3-4 IN. DIAM. OF CORE, 1 3-16 IN.

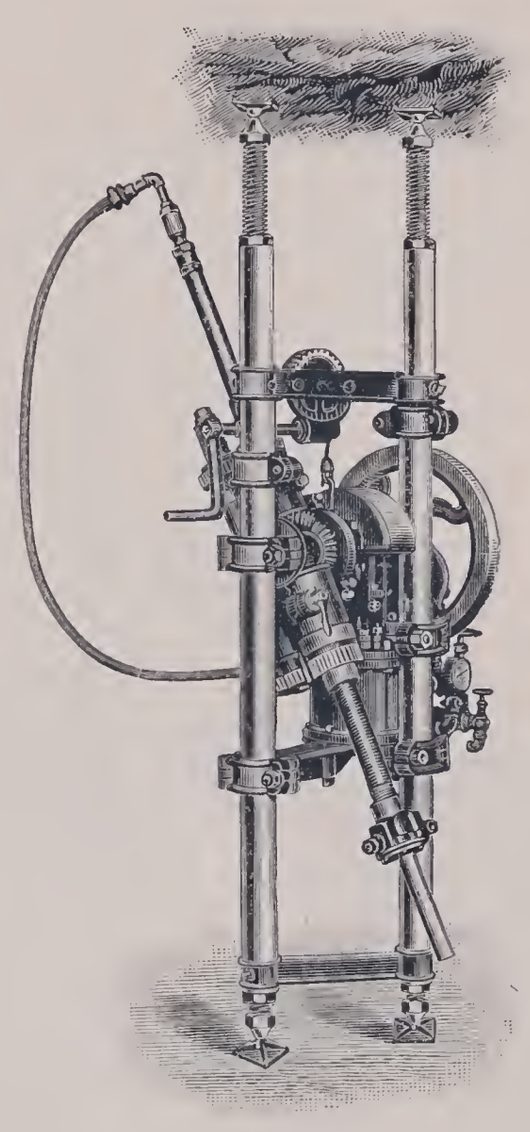
This Drill, in its hoisting apparatus and some other details, is modeled after the "B" Drill. It will give excellent results either in shallow holes or when called upon to work up to the extreme limit of its capacity.

For equipment furnished with the "C" Drill and included in the price, see page 22. For shipping weights and dimensions, see page 25.

SULLIVAN

DIAMOND PROSPECTING CORE DRILL.

SIZE "E."



CAPACITY, 300 FEET DEPTH. DIAM. OF HOLE, 1 1-2 IN. DIAM. OF CORE, 15-16 IN.

The "E" Drill was designed especially for underground prospecting, which is carried on very generally in mines that are systematically and economically operated. For this work a diamond drill must have all the requirements of a drill for surface prospecting, and in addition it must be capable of being operated in a small space; and it must be light and easily taken apart, so that it can be transported from place to place under ground without difficulty and without loss of time.

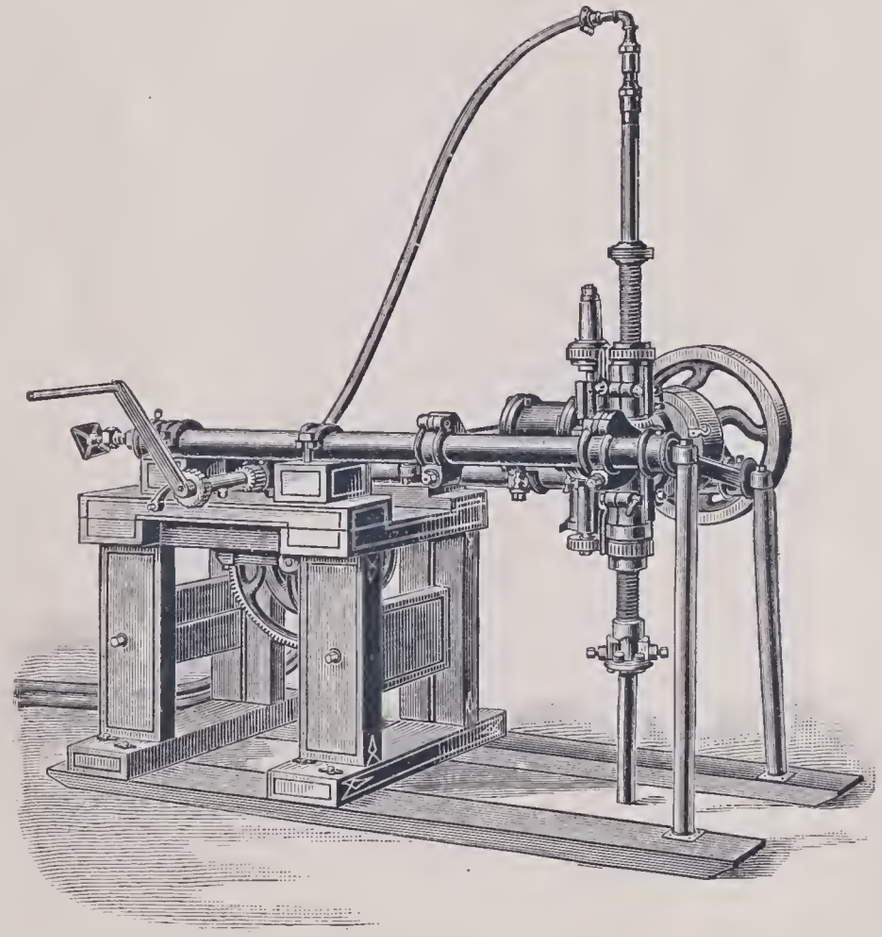
Our "E" Drill possesses all these requirements. It is supported directly between the standards, so that the line of greatest pressure coincides with the line of greatest resistance, and there is no tendency for the drill to twist and get out of line with the hole, as in other drills. In addition to the resistance to pressure given by

the standards, there is a system of braces, not shown in the cut, which are adjusted directly opposite to the thrust of the rod, thus making the drill absolutely rigid.

Especial attention is called to the small size and light weight of this machine, given below, and to the fact that it can be taken apart or set up in fifteen minutes, as showing how well it is adapted to underground work:

Weight of Drill complete, set up	580 lbs.
Heaviest piece	125 "
No other piece weighs over	75 "
Space required in line of Drill Rods	6 ft. 6 in.
Width 2 ft. 2 in. Height	5 ft. 8 in.
Weight of Drill and Frame set up for surface prospecting	830 lbs.

By using 12 inch runs instead of 20 inch, the distance required in line of Drill Rods is 5 feet 2 inches.



"E" DRILL ON FRAME FOR SURFACE PROSPECTING.

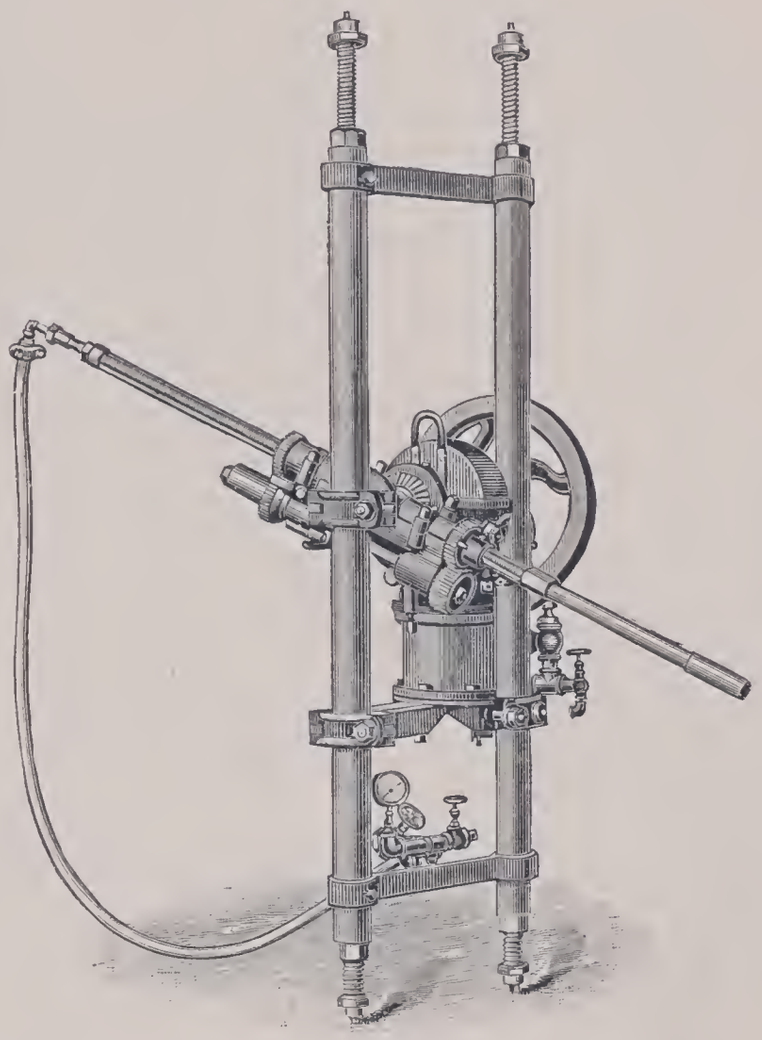
Some features of the "E" Drill—Engines, Friction Feed, Frame for Surface Prospecting, etc., have been mentioned in the general description of Sullivan Drills.

It remains to say only that the "E" Drill has met with great favor in the gold and silver mines of the West, and in the iron mines of the Lake Superior region, and New York and New Jersey.

For equipment furnished with the "E" Drill and included in the price, see page 22. For shipping weights and dimensions, see page 25.

SULLIVAN
DIAMOND PROSPECTING CORE DRILL.

SIZE "G."



CAPACITY, 300 FEET DEPTH. DIAM. OF HOLE, 1 1-2 IN. DIAM. OF CORE, 15-16 IN.

This is a drill of the same general features and capacity as the "E" but with some differences of detail. The drill-rods are screwed to the lower end of the feed-screw, without the interposition of a drive-chuck. This drill is provided with friction feed, and will do the same work as the "E" with equally accurate and satisfactory results.

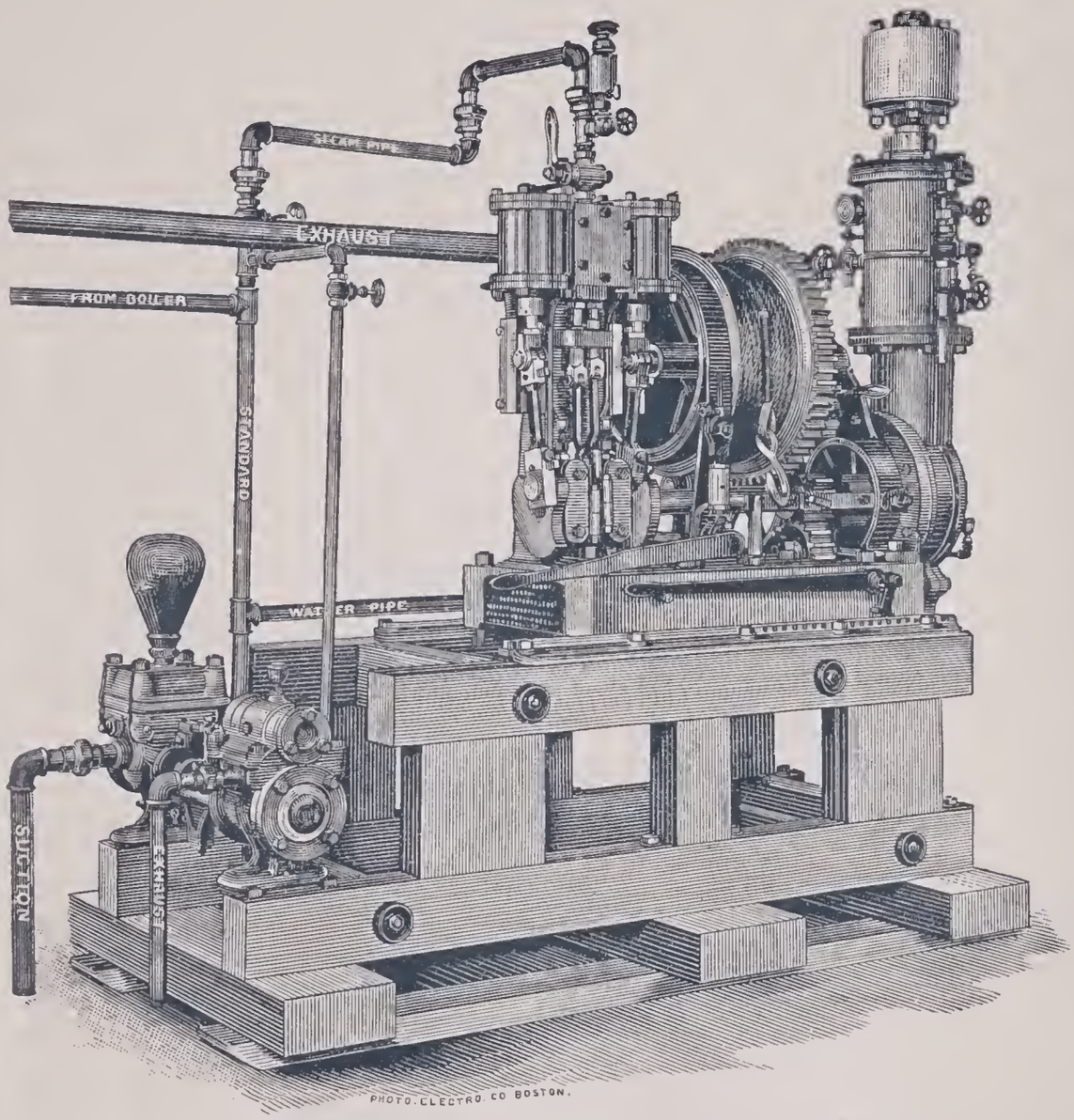
It is especially adapted to horizontal prospecting under-ground. A number of "G" Drills are in successful operation in the Lake Superior Mines.

For equipment furnished with the "G" Drill, and included in the price, see page 22. For shipping weights and dimensions, see page 25.

SULLIVAN

DIAMOND PROSPECTING CORE DRILL.

SIZE "H."



CAPACITY, 700 FEET DEPTH. DIAM. OF HOLE, 1 3-4 IN. DIAM. OF CORE, 1 3-16 IN.

This is a Hydraulic Feed-Drill, and as well and strongly built as the larger sizes. The cut shows one way of setting up the Sullivan Hydraulic Feed-Drills and of making steam and water connections to boiler and pump. The upper steam joint near the engines is a union, which is swiveled so as to allow the drill to be moved back and forth on the frame without breaking the joint. This connection may also be made with steam-hose, which allows greater freedom of motion of the drill.

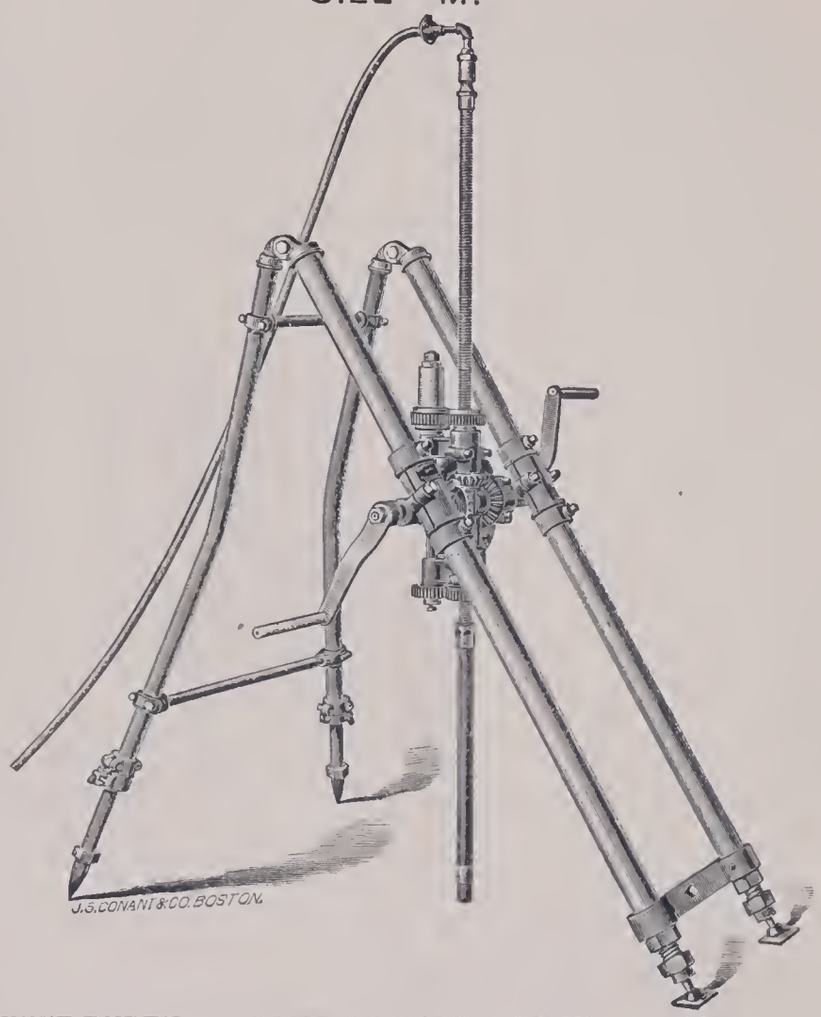
The vertical piece marked "Standard" is plugged or solid, and acts only as a support to the steam-pipes above.

In setting up the larger sizes of drills, the duplex pump used with them is placed beside the frame, usually at the left of the drill, for convenience in piping to the boiler. (See page 27.)

For equipment furnished with the "H" Drill, and included in price, see page 22. For shipping weights and dimensions, see page 25.

SULLIVAN
DIAMOND PROSPECTING CORE DRILL.

SIZE "M."



CAPACITY, 300 FEET DEPTH. DIAM. OF HOLE, 1 3-4 IN. DIAM. OF CORE, 1 3-16 IN.

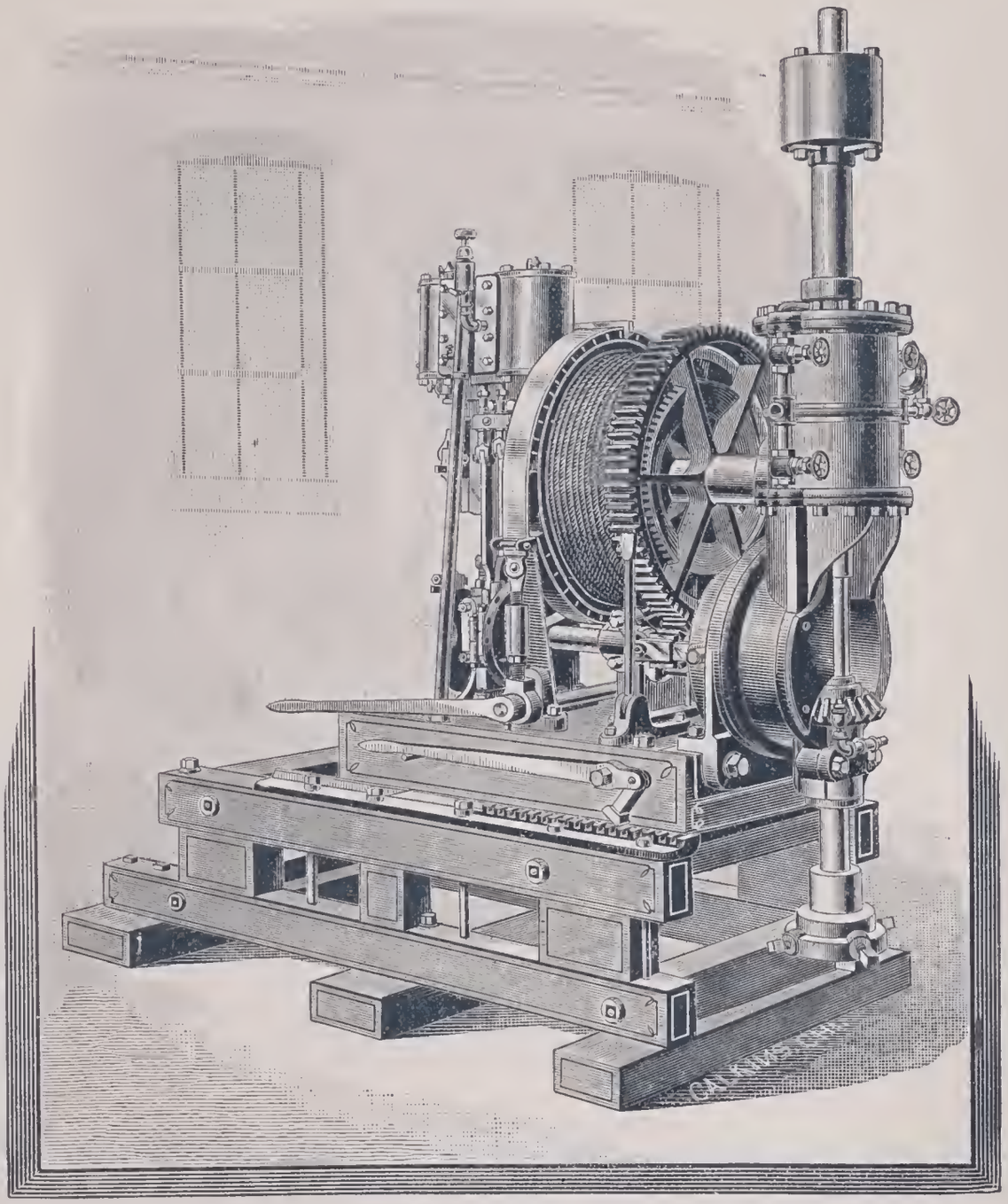
Where a comparatively small amount of land is to be developed, it often happens that the owner wishes to do it at different times, as suits his convenience, and yet does not wish to buy an expensive drill. To meet this demand, as well as that for a drill for prospecting in rough and mountainous country, where a steam-drill and boiler could not be transported, a special form of the Sullivan Drill has been designed, to be operated by hand-power or by belt. When a belt is used it can be run from a "Horse-power" or from an engine.

This drill, shown above, is mounted on hollow standards, with hollow back braces — an arrangement which combines strength, rigidity and light weight. Binding clamps allow change of position along the standards, and there is a swivel-joint in line of the crank-shafts, so that the proper setting can be had to bore a hole at any angle.

The "M" is built with the same care as the larger and more expensive drills. It has the same friction feed as the "E" and "G" Drills, and will do as accurate work. By means of the cranks shown in the cut, a hole can be drilled of size and depth specified above; or by belt-power a somewhat greater depth can be reached. When operated by hand-power, three men are required, two turning the cranks and one supplying water to the drill-rods by a hand-pump.

For equipment furnished with the "M" Drill and included in the price, see page 23. For shipping weights and dimensions, see page 25.

SULLIVAN
DIAMOND PROSPECTING CORE DRILL.
SIZE "N."



CAPACITY, 2000 FEET DEPTH. DIAM. OF HOLE, 2 3-4 IN. DIAM. OF CORE, 1 7-8 IN.

The "N" Drill is arranged with extra large swivel-head, drive-rod and hydraulic cylinder for drilling a 2¾ in. hole, removing 1⅞ in. core. Some idea of the power of this drill, and of one the special advantages of the hydraulic feed, can be gained from the fact that the hydraulic piston, eleven inches in diameter, can at any time be instantly subjected to a hydraulic pressure of at least 180 pounds per square inch, giving a total pressure of over *fifteen thousand pounds instantly available* to raise the rods *while the drill is running*, in case of any blocking or wedging in the hole. This is a feature not possessed by other diamond drills.

For equipment furnished with the "N" Drill and included in the price, see page 22. For shipping weights and dimensions, see page 25.

SULLIVAN

DIAMOND PROSPECTING CORE DRILL.

SIZE "P."

(See Frontispiece.)

CAPACITY 4,000 FT. DEPTH. DIAM. OF HOLE 2 3-4 IN. DIAM. OF CORE 1 7-8 IN.

THE Sullivan "P" Drill is the most powerful Diamond Drill built, and has a capacity far in excess of that required for any hole that has yet been drilled by a Diamond Drill in this country. It is always well, however, to have the available power greater than that which may be ordinarily needed; for the surplus can then be depended upon in case of certain emergencies that may occur in deep work, where its absence might cause much damage or delay.

It may be remarked in this connection, that it is well, in purchasing a machine, to select one a little larger than that just equal to the work contemplated, in case the drilling should be carried deeper than was expected.

The engines of the "P" are similar to those of the "B" and other smaller drills, but much more powerful. Its hoisting arrangement is very complete, consisting of (1) a friction hoist, in which a grooved wheel is pressed, by a hand-lever, into a raised V in the drum, turning it at the rate of one revolution to 4 of the engine; (2) a direct hoist, with ratio of 1 to 11; (3) by means of a set of back gears, a ratio 1 to 33; (4) by a second set of back gears, a ratio 1 to 50. By this arrangement a hoisting speed can be used, adapted always to the weight of rods to be raised, thus saving considerable time in hoisting from a great depth; for the different combinations can be thrown in or out in a few seconds, and several speeds used during one pull.

As this drill on its base-plate is too heavy to be easily slid back and forth on the frame, a special device has been made use of for this purpose. There are two axles passing through the base plate, with wheels at their ends, and hand-levers keyed to the axles. With the levers in the position shown in the cut, (frontispiece), the wheels are raised off the frame, and the base-plate clamped down to it. Raising the levers to a vertical position loosens the clamps by means of cams on the axle, and at the same time lowers the wheels to the track and raises the base-plate to rest on the axle and wheels. The drill can then be rolled back on the frame. Reversing the former operations clamps it again to the frame. Thus in spite of the weight of so powerful a machine, the work of moving it back and forth is done very quickly and easily, with no danger of disturbing the setting of the machine. This arrangement, either with the wheels, or with the sliding ways as in the lighter machines, is much simpler, easier and safer than the "Hinge Joint" used on some Diamond Drills.

The hydraulic cylinder of this machine is 14¾ inches diameter, which with 180 pounds pump pressure, gives a total available upward or downward pressure of over twenty-seven thousand pounds.

For equipment furnished with the "P" Drill and included in the price, see page 22. For shipping weights and dimensions see page 25.

EQUIPMENT TABLES.

The following equipment is furnished with the SULLIVAN DIAMOND PROSPECTING DRILLS A, B, C, H, N and P, without extra charge:—

1 Bit-Set with Carbons (black diamonds).
2 Blank Bits ready to set.
200 ft. of Drill-Rods with Couplings.
1 half length Drill-Rod with Coupling.
1 ten-foot Core-Barrel.
1 Core Lifter (consisting of shell and lifter).
50 ft. 4-ply Water-Hose with connection, for Drill-Rods.
12 ft. 4-ply Water-Hose with connection, to connect Drill and Pump.
20 ft. 4-ply Suction-Hose with Connection and Strainer.
3 ft. 5-ply Steam-Hose, with Connection, for Pump.
10 ft. 7-ply Steam-Hose with Connection, for Drill.
5 ft. two-ply Drip-Hose.
1 Swivel Steam Connection for Engine.
1 Wire Rope (wound on Hoisting Drum) with Hook; with A, C and H, 75 ft. of ½ in. Rope; with B and N, 100 ft. of ⅝ in. Rope; with P, 150 ft. of ⅞ in. Rope.
1 Safety-Clamp.
1 Sheave for Hoisting-Rods.
1 Hoisting Bale and Bolt.
1 Lifting-Swivel or Hoisting-Plug, with Coupling.
1 Water-Swivel with Coupling and Elbow.
1 Pressure-Gauge for Feed-Cylinder.
1 Tool Chest with Lock and Key.
1 complete set of Diamond-Setting Tools, consisting of:—
  1 3½ in. Jaw-Vise with Swiveled Base and Jaw.
  1 Breast-Drill with 5 Bits from ⅛ to ¼ in. diam.
  1 set of 12 Setting Chisels and Punches.
  1 Light Hammer for Diamond-Setting.
  1 pair each, six-in. Dividers, Inside and Outside Calipers.
  1 Head for holding Bits.
  1 lb. Copper Wire.
1 Machinist's Hammer
1 6-inch Adjustable Level.
2 prs. Pipe-Tongs, adjustable 1 to 2 inch.
1 14-inch Pipe-Wrench.
2 12-inch Monkey-Wrenches.
1 complete set of Solid Wrenches for Engine, Chuck, etc.
1 Malleable Hand Oiler.
1 1-gallon Oil Can.
1 Leather Packing Mould for Hydraulic Piston.
1 Steel Pin for Packing Box.
1 Engine Oil Cup with Valve.
2 Recovering Taps.
Rubber and Hemp Packing, and Waste.
All Pipe and Fittings necessary to connect Drill, Pump and Boiler.

The following equipment is furnished with the SULLIVAN DIAMOND PROSPECTING DRILLS "E" and "G," without extra charge:—

1 Bit set with Carbons.
2 Blank Bits ready to set.
195 ft. of Drill-Rods, with Couplings.
1 5-ft. Core-Barrel.
1 20-in. Core-Barrel
1 Core-Lifter Shell, with two Lifters.
17 ft. of 1-in. 4-ply Steam-Hose.
17 ft. of ¾-in. 2-ply Water-Hose.
7 ft. of ½-in. 2-ply Water-Hose.
1 Water-Swivel.
1 Lifting-Swivel.
1 Safety-Clamp.
1 Pressure-Gauge.
1 Tool-Chest with Lock and Key.
1 complete set of Diamond-Setting Tools, consisting of:—
  1 3½ in. Jaw Vise with swiveled base and jaw.
  1 Breast-Drill, with 5 Bits, from ⅛ to ¼ in. diameter.
  1 set of 12 Setting Chisels and Punches.
  1 light Hammer for diamond-setting.
  1 pair each 6-in. Dividers, Inside and Outside Calipers.
  1 Head for holding Bits.
  1 lb. Copper Wire.
1 Machinist's Hammer.
1 6-in. Adjustable Level.
1 pair Pipe-Tongs.
2 14-in. Pipe-Wrenches.
2 10-in. Monkey-Wrenches.
1 complete set of Solid Wrenches for engine, etc.
1 Malleable Hand Oiler.
1 half-gallon Oil Can.
1 Engine Oil Cup.
2 Recovering Taps.
Rubber and Hemp Packing, and Waste.
Valves and Fittings ready to connect to supply of steam or compressed air.

The following equipment is furnished with the SULLIVAN DIAMOND PROSPECTING DRILL "M" (hand-power), without extra charge:—

1 Bit set with Carbon.
2 Blank Bits ready to set
1 set of 12 Chisels and Punches for diamond setting.
1 Head for holding bits while setting.
100 ft. of Drill-Rods, with Couplings.
1 Lever Hand-Pump.
1 10-ft. Core-Barrel.
1 20-in. Core-Barrel.
1 Core-Shell and Lifter.
12 ft. of 1-in. 4-ply Suction-Hose.
10 ft. of ½-in. 2-ply Water-Hose.
1 Water-Swivel.
1 Lifting-Swivel.
1 Safety-Clamp.
1 Tool-Box with Lock and Key
2 pairs Pipe-Tongs.
1 14-in. Pipe-Wrench.
1 10-in. Monkey-Wrench.
1 complete set of Solid Wrenches.
1 Hand Oil-Can.
1 half-gallon Oil-Can.
1 Copper Strainer.
1 15-in. Pulley for attaching power to crank shaft.

EXTRA EQUIPMENT.

The equipment required with a Diamond Drill Outfit, besides that contained in the preceding tables, depends largely upon the locality in which the drill is to be used. If the work is near a town or good-sized mine where access can be had to a well-equipped blacksmith shop, the following list of necessary tools can be smaller than if the work is to be done in some locality away from a shop of any kind:

Boiler and Pump, with Injector, Flue-Cleaner, Poker, etc., and a Portable Forge, unless they are already available at the point where work is to be done.
1 Reamer for casing.
1 extra set (8) Carbons for reamer.
1 Steel Chopping-Bit for sinking stand-pipe.
2 Jacks, either the common Screw or the Ratchet-Jack. We recommend the latter, from the fact that it works much more quickly and effectually than the common jack.
Block and Tackle.
Chain-Tongs for screwing casing.
Drive-Head and Shoe for stand-pipe.
Pipe-Clamps suitable for drive-pipe and casing.
Hand-Saw, Axe, Shovel.
1 Pipe-Cutter.
1 set Stocks and Dies, ½ in. to 3 in.

DATA TO BE GIVEN

WHEN INQUIRING IN REGARD TO PURCHASE OF DRILLS.

Maximum depth to be drilled in any one hole.

Material to be prospected for.

Probable amount and character of drift or loose material above the rock—whether sand, quicksand, clay, gravel, bowlders, etc. Upon this depends the size and probable length of standpipe.

Probable character of of the rock formations—whether hard or soft, solid or broken.

Will Boiler or Pump be required? Also, what other extra equipment?

WHEN INQUIRING IN REGARD TO CONTRACT PROSPECTING

Give all the data mentioned above, except in regard to Boiler and Pump, which are always a part of our contract outfits. Also state amount of work which will be guaranteed, distance of location from railroad freight station, general character of country as regards hauling of machinery, rate per day for teams, availability of boarding places for men, and similar information.

TABLE OF

SIZES, CAPACITIES, DIMENSIONS AND OTHER DATA

OF THE

Sullivan Diamond Prospecting Core Drills.

Size of Drill.	Capacity. Depth of Hole. Feet.	Capacity. Diam. of Hole. In.	Diam. of Core. In.	Steam Pipe. In.	Exh'st Pipe. In.	Pump Required. See Page 38	Boiler Required for Drill and Pump. See Page 27. H. P.	Space Required. Drive-Rod in Lowest Position. Floor Space.	Space Required. Drive-Rod in Lowest Position. Height.	Price, F. O. B. Chicago.
A	1200	1¾	1 3/16	1	1½	6 x 3 x 7	12	3 ft. 6 in. x 6 ft. 3 in.	6 ft. 9 in.	.....
B	3000	2	1⅜	1¼	2	6 x 3 x 7	15	3 ft. 9 in. x 7 ft. 0 in.	7 ft. 6 in.	.....
C	1200	1¾	1 3/16	1	1½	6 x 3 x 7	12	3 ft. 6 in. x 6 ft. 3 in.	6 ft. 9 in.	.....
E	300	1½	15/16	1	1¼	4½x2⅜x5	8	See page 16, also		.....
G	300	1½	15/16	1	1¼	4½x2⅜x5	8	Note 2 below.		.....
E on Frame.	300	1½	15/16	1	1¼	4½x2⅜x5	8	2 ft. 6 in. x 6 ft. 3 in.		.....
H	700	1¾	1 3/16	1	1½	4½x2⅜x5	10	3 ft. 2 in. x 6ft. 3 in.	6 ft. 6 in.	.....
M	300	1¾	1 3/16	Hand or Belt Power Drill.				See note 2 below.		.....
N	2000	2¾	1⅞	1¼	2	6 x 3 x 7	20	3 ft. 9 in. x 7 ft. 3 in.	7 ft. 6 in.	.....
P	4000	2¾	1⅞	1¼	2	8 x 4 x 12	25	4 ft. 1 in. x 7 ft. 6 in.	10 ft. 6 in.	.....

It should be borne in mind that—

1. Holes can be increased in diameter to any desired size by using a Reaming-Bit. Also, by using a larger core-barrel, lifter and bit, a larger hole can be drilled than that given in column three.

2. Space required for E, G and M Drills depends upon the position of the standards and braces, which are placed to suit the surroundings and the direction of drilling. For space in which the E Drill can be operated, see page 16. Height of M drill to top of standards about 5 ft. 6 in.

3. Prices are f. o. b. Chicago, unless otherwise specified. An extra charge is made for packing for export, or any other unusual shipping expense.

SHIPPING WEIGHTS AND DIMENSIONS.

A OR C DRILL.

Weight of Drill *without* Swivel-Head...1060 lbs.
" Swivel-Head boxed separately, 380 "
" Frame..... 440 "
" Equipment, page 22 .....1450 "

Total Weight, Drill and Equipment. ..3330 lbs.

In 9 boxes, occupying, with Drill and Frame, about 111 cubic feet.

Weight of Rods, boxed, with Couplings, per 100 ft..... 340 lbs.
Weight of 12 H. P. Boiler on Wheels ..5400 "
" 6x3x7 Duplex Pump .....1200 "

B DRILL.

Weight of Drill *without* Swivel-Head...1950 lbs.
" Swivel-Head boxed separately, 530 "
" Frame..... 600 "
" Equipment, page 22 .....1620 "

Total Weight, Drill and Equipment ....4700 lbs.

In 9 boxes, occupying, with Drill and Frame, about 132 cubic feet.

Weight of Rods, boxed, with Couplings, per 100 ft..... 380 lbs.
Weight of 15 H. P. Boiler on Wheels. 5800 "
" 6x3x7 Duplex Pump .....1200 "

E OR G DRILL.

Weight of Drill complete ..... 580 lbs.
" Equipment, page 22 .....1145 "

Total Weight, Drill and Equipment....1725 lbs.

In 10 boxes, containing Drill and Equipment, and occupying about 32 cubic feet.

Weight of Rods, boxed, with Couplings, per 100 ft..... 360 lbs.
Weight of 8 H. P. Boiler on Wheels ...4550 "
" 4½x2⅜x5 Special Pump .... 350 "

NOTE.—The heaviest piece of E or G Drill weighs only 125 lbs , and no other piece over 75 lbs. The frame used with the E drill for surface work weighs about 250 lbs., and occupies about 13½ cubic feet.

H DRILL.

Weight of Drill *without* Swivel-Head... 880 lbs.
" Swivel-Head boxed separately, 360 "
" Frame..... 370 "
" Equipment, page 22 .....1420 "

Total Weight, Drill and Equipment....3030 lbs.

In 9 boxes, occupying, with Drill and Frame, about 95 cubic feet.

Weight of Rods, boxed, with Couplings, per 100 ft..... 340 lbs.
Weight of 10 H. P. Boiler on Wheels ..5100 "
" 4½x2⅜x5 Special Pump .... 350 "

M DRILL.

Weight of Drill complete..... 250 lbs.
" Equipment, page 23 ..... 650 "

Total Weight, Drill and Equipment .... 900 lbs.

In 5 boxes, containing Drill and Equipment, and occupying about 30 cubic feet.

Weight of Rods, boxed, with Couplings, per 100 ft..... 250 lbs.

Boiler not needed for Hand-Power Drill. Lever Hand-Pump included in Equipment.

N DRILL.

Weight of Drill *without* Swivel-Head...2000 lbs.
" Swivel-Head boxed separately, 600 "
" Frame..... 600 "
" Equipment, page 22 .....1800 "

Total Weight, Drill and Equipment....5000 lbs.

In 9 boxes, occupying, with Drill and Frame about 134 cubic feet.

Weight of Rods, boxed, with Couplings, per 100 ft..... 550 lbs.
Weight of 20 H. P. Boiler on Wheels..7050 "
" 6x3x7 Duplex Pump .....1200 "

P DRILL.

Weight of Drill complete, *with* Swivel-Head.....5000 lbs.
Weight of Frame ..... 820 "
" Equipment, page 22 .....2900 "

Total Weight, Drill and Equipment....8720 "

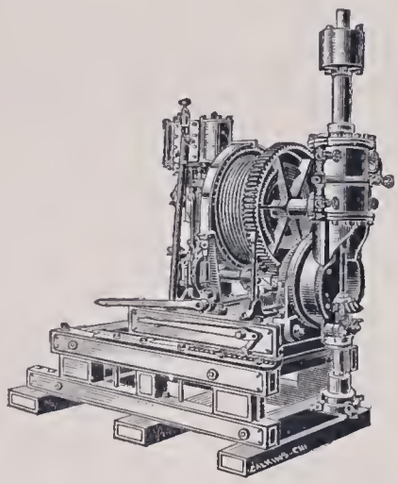
In 12 boxes, occupying, with Drill and Frame, about 200 cubic feet,

Weight of Swivel Head and Drive Rod when detached, about.....1100 lbs.
Weight of Rods, boxed, with Couplings, per 100 ft..... 550 lbs.
Weight of 25 H. P. Boiler on Wheels..7900 "
" 8x4x12 Duplex Pump .....2400 "

SURFACE PROSPECTING

WITH THE

SULLIVAN DIAMOND CORE DRILL.



SO various are the conditions of drilling prospect holes in different parts of the country, in different seasons and for different depths and material penetrated, that it is impossible to describe processes which will be applicable to all cases. In what follows we shall endeavor to give a general description of the work of prospecting, with some of the difficulties which may at any time be encountered, and ways of avoiding them, or of overcoming them after they have appeared, together with some mention of the tools used in general on work of this kind. Limited space prevents a complete description, yet what is given may be found of value to those interested in the development of mineral lands, as showing the thorough manner in which Diamond Drill Prospecting is conducted, and the means adopted to secure rapid and accurate work with the SULLIVAN DRILL and the special tools and devices used with this machine. In case of peculiar accidents or difficulties, we shall be pleased to give correspondents the benefit of our wide experience in all kinds of prospecting, and can send men to take charge of and operate Diamond Drills until the difficulty is passed.

LOCATION OF PROSPECT HOLE. The approximate location of the prospect hole is determined by the extent, location and general features of the land to be developed. Besides these general determining features, there are others due to the requirements of the drill and outfit. The ground should be reasonably good for hauling. The site selected should be suitable for the erection of the drill shanty and for raising the poles of the tripod or derrick. The outfit should be placed within reach of a good supply of water for the pump; if this is not practicable, water must be hauled for this purpose. When the available supply of water is limited, it may be used over and over by allowing the water as it comes from the hole to run back into the tank or well from which it was pumped, after the cuttings have settled. By so doing, only enough water need be hauled to supply the waste.

FOUNDATION AND FLOOR. It is customary to lay four timbers, size about 6x8 or 8x10 inches, and 12 feet long, for the foundation of the drilling plant, covering about 12 square feet on the ground. These are leveled up, and a floor of sound two-inch planks laid across them. The drill and pump are set on this floor—the former a little back of the middle, directly over two foundation timbers running parallel with length of drill, about three feet apart. The drill is bolted to these two timbers. A hole is cut in the floor in front of the drill, through which the pipe is afterwards sunk and the rods pulled and lowered in drilling.

THE SHANTY. With these heavier pieces in position, the shanty is erected over them. A common shed-roofed shanty answers every purpose. It should be built in sections, bolted together, so that it can be easily taken down and put up again. A convenient size is 12 x 12 feet, 7 feet high at lower end and 9 feet at higher end, with roof strong enough to walk on, as two or three men are frequently on it. A roof of one inch sound Norway pine, with matched joints, answers every purpose of support and protection. It should have a hole directly over the bore hole large enough to admit the drive block. The rods and attached hose also pass through this hole in drilling and in pulling and lowering. In mild weather the shanty encloses only the 12x12 floor. In cold weather the boiler is also enclosed, and keeps the shanty warm.

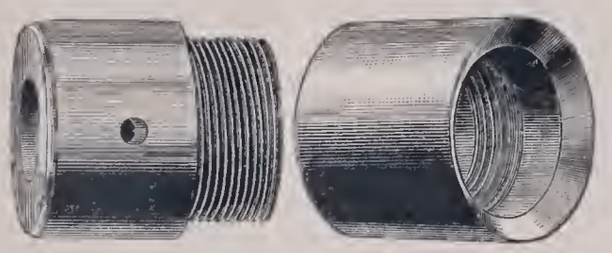


Fig. 6. Drive-Head and Shoe.

BOILER. The most usual kind, where it can be hauled about, is an ordinary horizontal portable boiler, mounted on wheels. It is sometimes more convenient to use a vertical boiler, which can be carried on sleds ; and in some cases where transportation is very difficult, a sectional boiler is necessary, which can be "packed" from place to place. Capacities of boilers required for the different drill outfits are given on page 35. It must be borne in mind that these boilers have to furnish steam for both drill and pump. A smaller boiler than that given in the table would be ample for ordinary work, as the SULLIVAN DRILLS are economical in use of steam, as are also the pumps we furnish. The larger boiler is recommended so that the surplus power available can be instantly drawn upon in case of emergency.

The position of the boiler is usually at the left of the platform just described, and close to it for convenience in piping to drill and pump. This would be the side nearest the observer in the cut of "H" Drill on page 18. The fire door is towards the front of the shanty, wheels about 18 inches from the platform, and the dome should be nearly opposite the drill hole, so that the steam valves to pump and drill can be easily reached by the operator as he stands in front of the drill. The boiler may be hauled into position before the shanty is put up.

PUMP. With the pump tables will be found a note giving the size of pumps suitable for our drills. We handle two excellent makes of pumps, which we can recommend for all drilling and mining service. For our power drills we use special pumps, with large steam cylinders, capable of working with water pressure of 150 to 200 pounds. Our "M" Hand-Drill is provided with a lever hand-pump furnished with the outfit.

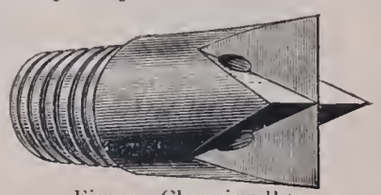


Fig. 7. Chopping-Bit.

CONNECTIONS. Connections for steam, exhaust and water can be made by any competent drill-runner. Our outfits when shipped include pipe, hose and fittings for all ordinary setting up. Connections should be as short and straight as possible, and for winter, arrangements must be made to protect exposed pipes, and to drain all pipes when left over night. Also, the hydraulic cylinder should be drained in cold weather, by means of petcocks provided for that purpose.

TRIPOD OR DERRICK. The kind of derrick to be used depends largely upon the material available, and the work to be done. A common tripod of poles 36 feet long, fastened together at the top with a heavy bolt, and with a bale for hanging the sheave, answers every purpose for depths up to 1,000 feet for the smaller drills. For greater depths and for larger drills, a framed and braced four-pole derrick is recommended. This can have main poles 6x4, with 1x6 cross-braces, and should be of a height sufficient for uncoupling, the rods in sections 20, 30 or 40 feet in length. The derrick may be about 12 feet square at the bottom, and 3 or 4 at top, the lower part built into the shanty, and with platforms above, 10 feet apart, to stand on while uncoupling the rods. It should be put together with bolts, for convenience in shipping.

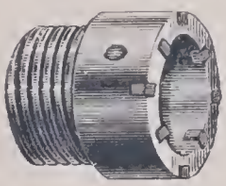


Fig. 8. Diamond-Bit.

STAND-PIPE. When the first rock stratum is only a few feet below the surface, the stand-piping is very quickly and easily done. Usually, however, there is from 15 to 20, up to 300 feet or more of sand, gravel, clay and other drift material to be penetrated, and through this pipes must be sunk to the rock, so as to keep out all this loose material while drilling. The size, quantity and kind of stand-pipe depends upon local circumstances. If much drift is anticipated, it is better to start with a large pipe, driving it as far as possible, and finishing with one or two smaller sizes. Where several sizes are used, each is subjected to only part of the friction of the loose material in pulling it out, and hence is more easily pulled. The smallest size of stand-pipe must admit the largest casing to be used. (See page 31.)

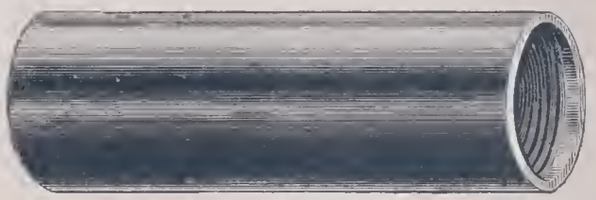


Fig. 9. Core-Shell.

DRIVING STAND-PIPE. A good way of starting the pipe through soft clay is to drill a hole to any practicable depth, large enough to admit the stand-pipe, which is then lowered into it. Beyond this depth the pipe must be driven. A *Drive-Head and Shoe* (Fig. 6) are screwed to top and bottom of the pipe, the head receiving the blows of a heavy hard-wood or iron drive-block, the shoe cutting its way through the drift. The drive-block is raised by the engine and hoisting rope, and dropped from a suitable height, striking 25 to 50 blows in a minute. A wash-pipe is lowered inside the drive-pipe, following the shoe down and stirring up the loose material, which is carried to the surface by a stream of water forced down inside the wash-pipe. This stream will wash up sand and clay, and gravel up to about 1½ inches in diameter. Where coarser gravel or bowlders are encountered, they must be chopped to pieces.

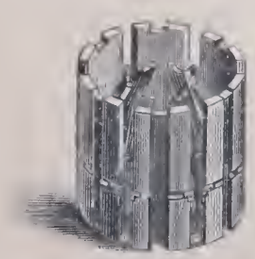


Fig 10. Core-Lifter.

CHOPPING. For this purpose *Chopping-Bits* are used (Fig. 7). These are made of steel, with hardened chisel-shaped edges, and are screwed to the lower end of the wash-rod. Rod and bit are then jumped up and down, as in driving, breaking the bowlders.

When rock is reached, the stand-pipe must be driven onto it so as to make a tight joint, to prevent the escape of water from the hole. If a tight joint can not be had at bottom of stand-pipe, the rock must be drilled into a short distance, and casing inserted, when the sediment settling around it will keep the water in the hole.

DRILLING. With the work carried as far as described, everything is ready for the drilling proper. This, when commenced, is carried on night and day,

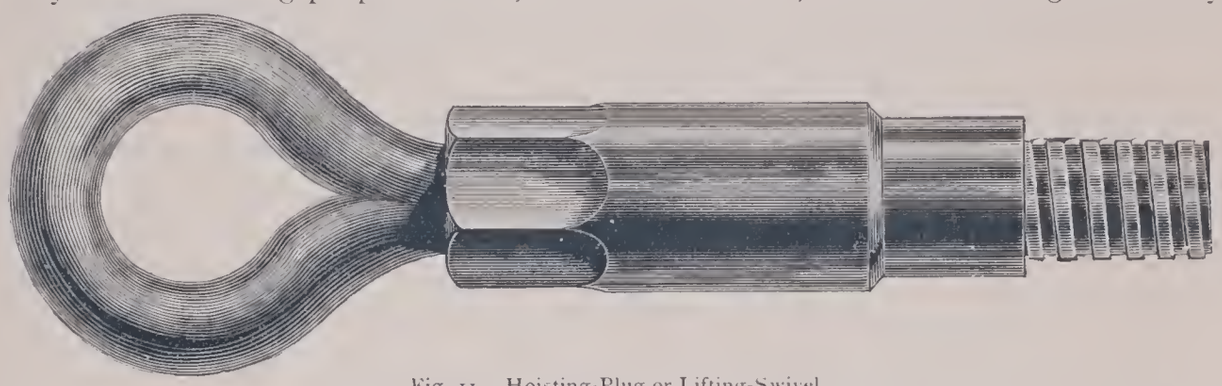


Fig. 11. Hoisting-Plug or Lifting-Swivel.

to make the most rapid progress possible. The drill outfit is in charge of a foreman. In soft formations, the foreman sets the bits and runs the drill day-times with his helper, who fires the boiler. The assistant foreman runs the drill at night. In hard formations the foreman spends all his time setting bits, and has two assistants to run the drill. All the men work together while sinking the stand-pipe, the night-work beginning with the drilling.

BIT, CORE-SHELL AND CORE-BARREL. Figs 8 and 9 show the bit and core-shell, by means of which and the core-lifter and core-barrel, the hole is drilled and the core formed, broken off and held while brought to the surface. These tools are also shown in their relative positions in Fig. 4, page 9. The bit first penetrates the rock. . It is set, on its lowest face and inner and outer edges, with the small pieces of "black diamond or carbon." This is a form of pure carbon, as hard as the brilliant, but of a dark gray or reddish black color, opaque and not crystalline. Stones of one to three karats weight are used in ordinary drilling.

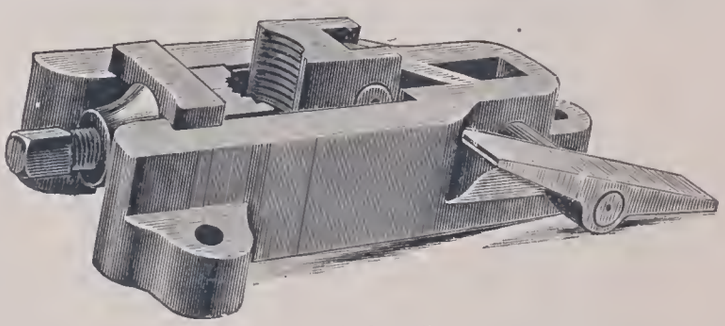


Fig. 12. Safety-Clamp.

CORE-LIFTER. As the bit is rotated and fed forward, the diamonds chip and grind away the rock in an annular hole, leaving untouched in the center a cylindrical "core." The bit passes down over this core followed by the core-shell and core-barrel. The latter is a smooth-bored tube in which the core is enclosed.

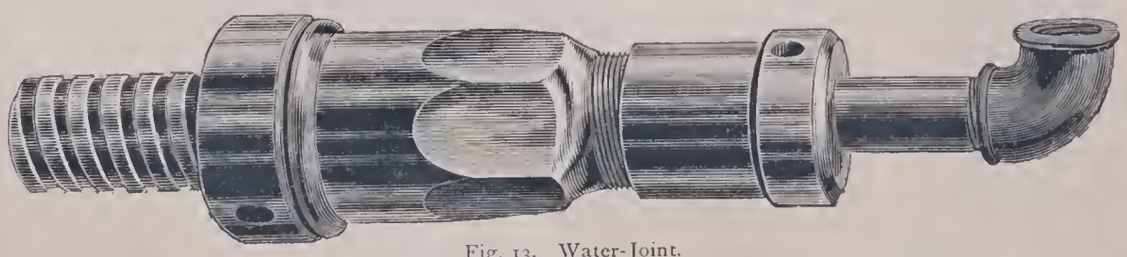


Fig. 13. Water-Joint.

The *Core-Lifter*, Fig. 10, is placed in the shell with the loose jaws pointing upward as shown. The jaws allow the lifter to move down over the core; but when the rods are raised, the jaws grip the core, hold it firmly, and as the rods rise, break it off.

LOWERING THE RODS. The drill being slid back out of the way, on its frame, the bit and core-shell are screwed to the bottom of the core-barrel, lowered into the hole and supported while a drill-rod is screwed into the upper end of the core-barrel. The *Hoisting-Plug or Lifting-Swivel* (Fig. 11) is then screwed into the upper end of the drill-rod, the hoisting rope hooked on, and the rods lifted a few inches while the supporting clamp is taken off. Disconnecting the hoisting gears, the core-barrel and rod are lowered by the brake until the hoisting plug is a few inches from the floor, when the *Safety-Clamp* (Fig. 12) is placed around the drill-rods.

This tool is provided with toothed jaws, so arranged as to be closed together by the downward pull of the weight of the rods, holding them firmly, and yet easily loosened by any *upward* movement of the rods. Thus the rods can at any time be pulled up through the clamp, which, however, grasps and sustains them as soon as the upward movement ceases and the weight of the rods falls on the clamp; it is, in fact, self-operative, and prevents the rods from dropping into the hole in case of breakage of hoisting rope or sheave.

The last drill-rod to be screwed on is first passed through the drive-rod of the drill, which is moved forward over the hole at this time. The rods are then lowered carefully to the bottom, if the hole is clean, and the *Water-Joint* (Fig. 13), also *Q*, (Fig. 4) being attached, and the feed-piston in its highest position, and the rods held fast in the chuck, *L*, drilling is begun. The operation of feed-valves and piston has been described on page 8. When the piston reaches the bottom of the cylinder, the chuck is loosened, and by shutting valves 1 and 3, and opening 2 and 4, the piston runs up in a few seconds, the rods resting on the bottom of the hole; the chuck then grasps them again, and the drilling continues, additional rods being added at the top as the hole becomes deeper.

Fig. 14. Lifting-Bale and Clevis.

The water-joint is connected with the pump while drilling, and a stream of water is constantly forced through it and down inside the rods, coming out through the bit at the bottom of the hole, and rising to the surface through the clearance space cut by the diamonds in the outer face of the bit. This stream of water keeps the diamonds cool, and washes up the cuttings, keeping the hole clean, and enabling the operator to tell, from the appearance of the cuttings and the color of the water, the nature of the rock being penetrated.

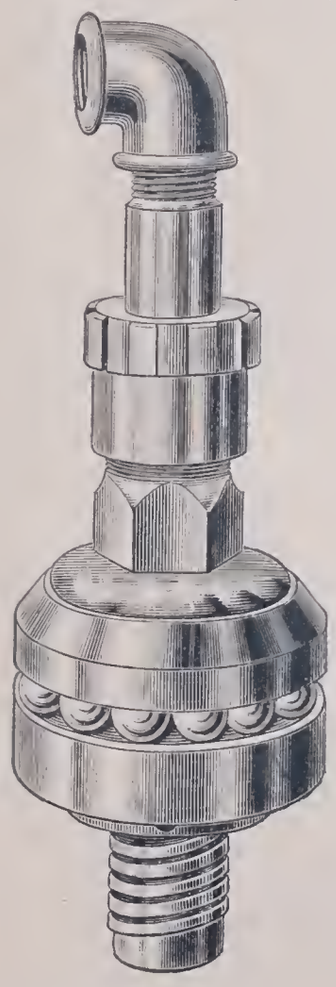


Fig. 13. Improved Water-Joint.

If the hole has mud or broken rock in the bottom, the rods are lowered to this, the water-joint attached, and the water forced through the rods while they are lowered to the bottom, washing up the mud and bits of rock.

PULLING UP.—After drilling as many runs as will fill the core-barrel, the rods are pulled up until the top joint reaches the surface, disconnected at that joint, and

the drill moved back on the frame, out of the way. The rods are then hoisted through the safety-clamp, and uncoupled in double lengths, or longer, the helper standing on the platform, at a suitable height on the tripod or derrick. When the core-barrel, shell and bit reach the surface, the lifter is unscrewed from the barrel, the core removed in exact order, in pieces up to three or four feet or more in length. Solid pieces of the core can be subjected to physical and chemical tests, and thus the exact nature of the mineral, as well as its depth and the thickness of the vein, can be determined with perfect accuracy.

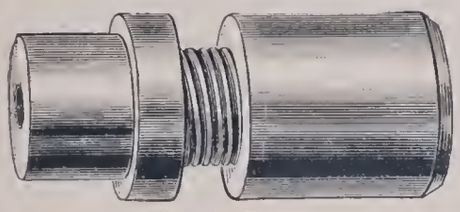


Fig. 16. Reamer.

ECONOMY OF TIME.—The operations of pulling and lowering the rods are conducted by the two men operating a shift, one standing at the drill and his helper on the roof or platform above. They work together in such a manner that both are constantly busy, and no time is lost between the successive operations. By this arrangement several hundred feet of rods can be pulled or lowered in a very few minutes.

LIFTING-BALE AND CLEVIS.—When the water-joint is attached, before the bottom of the hole is reached, the rods are suspended from a *Lifting-Bale and Clevis* (Fig. 14). The clevis is placed around the rods under a shoulder on the water-joint, and the bale hangs from the hook on the hoisting rope.

IMPROVED WATER-JOINT. Fig. 15 shows this tool, which allows the rods to be kept turning while lowering through mud or broken rock, with a stream of water passing through them as in drilling, and washing up the mud and bits of rock. The bale and clevis are attached as in the case of the ordinary water-joint, and do not turn with the rods, which hang on a friction ball roller bearing.

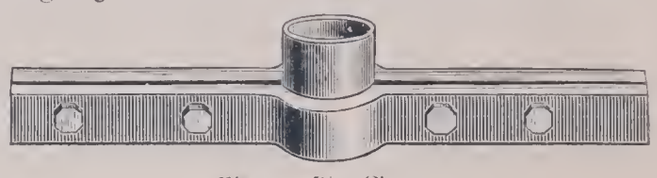


Fig. 17. Pipe-Clamp.

REAMING AND CASING. Casing-pipe is used to keep the hole clean and to prevent caving. When its use is found necessary, the hole is enlarged to a suitable diameter by means of a *Reamer*, shown in Fig. 16. This consists of a guide the size of the drilled hole, and a face above in which diamonds are set and which cut away the sides of the hole, following the guide. No core is made in reaming, as the object is simply to enlarge the hole. The lower piece, consisting of guide and face, is screwed into the head, and thus the guide and face can be renewed, when worn out, without the necessity of replacing the head. And as the screws are of the same diameter in reamers of different sizes, any head can be used with any face and guide, and the number of necessary drilling tools thereby reduced. Water passes through the reamer, as through the bit in drilling, and washes up the cuttings.

Fig. 18. Flush Joint Casing and Protectors.

When necessary to ream and case below casing already in the hole, the latter may be pulled out, and the hole continued the same size; or the first casing may be left in, and the hole reamed out to admit casing of a smaller size, provided it in turn will admit the drill rods. For "A" core-barrel (see page 47) the smallest casing should be at least 2 inch; for "B" core-barrel, 2 ½ inch; for "E" core-barrel, 2 inch; for "M" core-barrel, 2 inch; for "N" core-barrel 3½ inch.

Each size of stand-pipe and casing comes to the surface, where there are thus always several sizes of pipe, concentric. Pipe being lowered within larger pipe is held, as each joint is made at the surface, by a *Pipe Clamp* shown in Fig. 17.

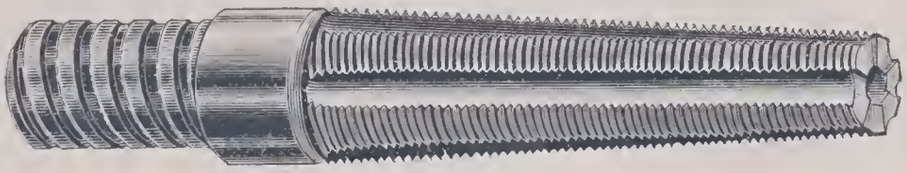


Fig. 19. Taper Recovering-Tap.

Casing may be of ordinary pipe, but this is difficult to pull out on account of the couplings. "Inserted joint" casing is used in some cases.

FLUSH JOINT CASING. Where casing must be frequently pulled, we recommend *Flush Joint Casing*, described on page 47. Fig. 18 shows a short piece of it, provided with cast-iron protectors to save the threads from injury in shipping.

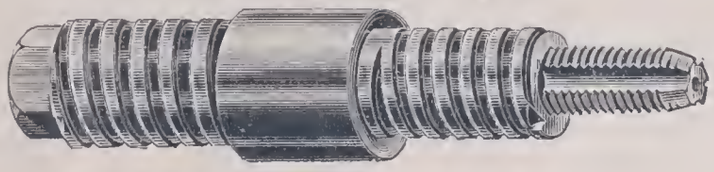


Fig. 20. Coupling and Coupling-Tap.

RECOVERING-TAPS. Figs. 19, 20 and 21 show three forms of these tools, which are used to pull the rods to the surface in case of breaking them or dropping them into the hole.

INDICATIONS OF THE MACHINE IN DRILLING. By observing gauges attached to the hydraulic cylinder, and by watching the operation of the drill, the operator can tell at once when the character of the rock being penetrated changes. All these indications of the machine and gauges should be closely watched, as well as the cuttings as they come to the surface. For the indications show the thickness of strata, and the cuttings the character of the rock, before the core is pulled up; and they and the core act as checks, which establish the accuracy of the work beyond question. *On entering a vein of coal or soft ore*, these indications are *especially marked*, and give positive evidence of the presence of the mineral.

RUNNING THROUGH COAL. On reaching coal it is customary to run into it a few inches, then pull up, put everything in perfect order, and put down again to run through the vein. By so doing there is no other core to grind away in the core-barrel and come up with the cuttings, or to grind away the coal itself.

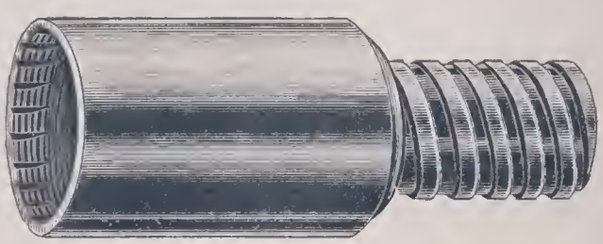


Fig. 21. Hollow Tap.

SPECIAL DEVICES FOR COAL PROSPECTING. We have a number of tools specially designed for prospecting in coal regions; among them our "No. 663" core-barrel and lifter. These are so arranged that the lifting-jaws are kept entirely away from contact with the core while drilling, which prevents grinding it away, and saves the largest possible amount of core in soft formations. By means of these special tools, and the gauges with which the SULLIVAN DRILL is provided, pefectly reliable results can be obtained.

IN GENERAL. Such is the general method of prospecting, which is applicable to all minerals, to wells of all kinds, and to hard or soft rock. The requirements of special cases will introduce many other processes, and the necessity for special devices, which can not be described here.

PROSPECTING BY CONTRACT.

We wish to call attention to the fact that we are contractors for the use of the SULLIVAN DIAMOND PROSPECTING DRILLS in all kinds of Diamond Drill work.

We have for the past five years been actively engaged in prospecting work, in which we have gained a wide and varied experience. We have from five to ten drill outfits in active operation on contract work, and can always arrange to take up new work promptly and push it through to a rapid and satisfactory conclusion.

By our policy of keeping our Drill Foremen constantly employed, so long as they prove competent and satisfactory, we have secured a corps of sober, reliable men, who are thoroughly conversant with the geological formations of the country. We can furnish men who have a thorough knowledge of the gold and silver mining regions of Lake Superior, Colorado, Dakota and other points west and northwest; the iron regions of the Vermilion, Menominee, Gogebic, Marquette and other Ranges, and of New York, New Jersey and the South; the rock salt formations of the West; and the coal formations of the entire country.

From these facts, and with the improved machinery and tools which we use, we are able to guarantee reliable, prompt and satisfactory work.

We take pleasure in calling attention to the fact that our contract work since 1884, has amounted to *over ninety-seven thousand feet.* More than 25,000 feet of this work has been done for one company in Iowa, and 15,000 feet for one in Illinois, which speaks well for the satisfaction which our prospecting work has given.

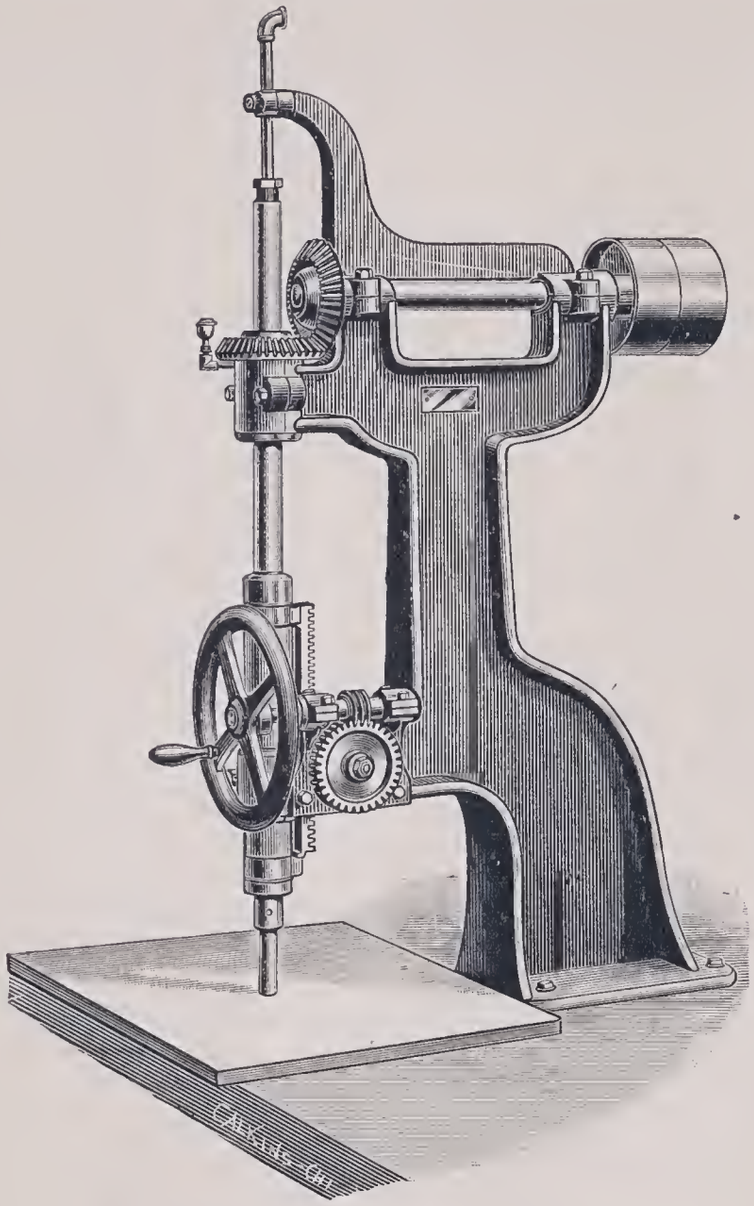
We solicit correspondence in regard to prospecting mineral lands, sinking wells of all kinds, submarine work, drilling for mine ventilating and drainage holes, making engineers' tests of masonry, and all work to which the DIAMOND DRILL is applicable. We will furnish estimates on receipt of information as to the conditions of work to be performed. See page 23 for data required.

INFRINGEMENTS.

Certain parties who have had a monopoly of the Diamond Drill business, owing to certain patents, covering the Diamond Core-Bit, which have expired, have claimed that the SULLIVAN DRILL infringes on their rights. This is absolutely false. The particular devices that give the great advantages possessed by the SULLIVAN DIAMOND DRILL are patented and owned by the manufacturers of that drill, and great care has been taken to determine the fact that they infringe on no other rights. We guarantee to protect all parties purchasing the SULLIVAN DIAMOND CORE DRILL in all suits arising from claims made by others that any part of the drill is an infringement on other patent rights.

SULLIVAN

DIAMOND POINTED BENCH DRILL.



This Drill is intended for the use of manufacturers of marble articles, such as soda fountains, mantels, plumbers' goods, and for all similar stone work where accuracy in the size and location of holes is required. By using a diamond bit, the edges of the hole are left smooth and clean, and not chipped and broken as when a chisel or steel drill is used.

The Bench Drill is 54 inches high, and occupies a space 32 inches long and 17 inches wide. There are two tight and loose pulleys, 7 inches diameter and 3 inches face. Speed can be from 500 to 1200 revolutions per minute, according to the size of hole, which can be from 5/8 inch to 1 inch diameter, or larger if desired. Water passes through the diamond bit as in the case of the prospecting core-drills, keeping the diamonds cool and the hole clean.

Shipping weight, 375 pounds.

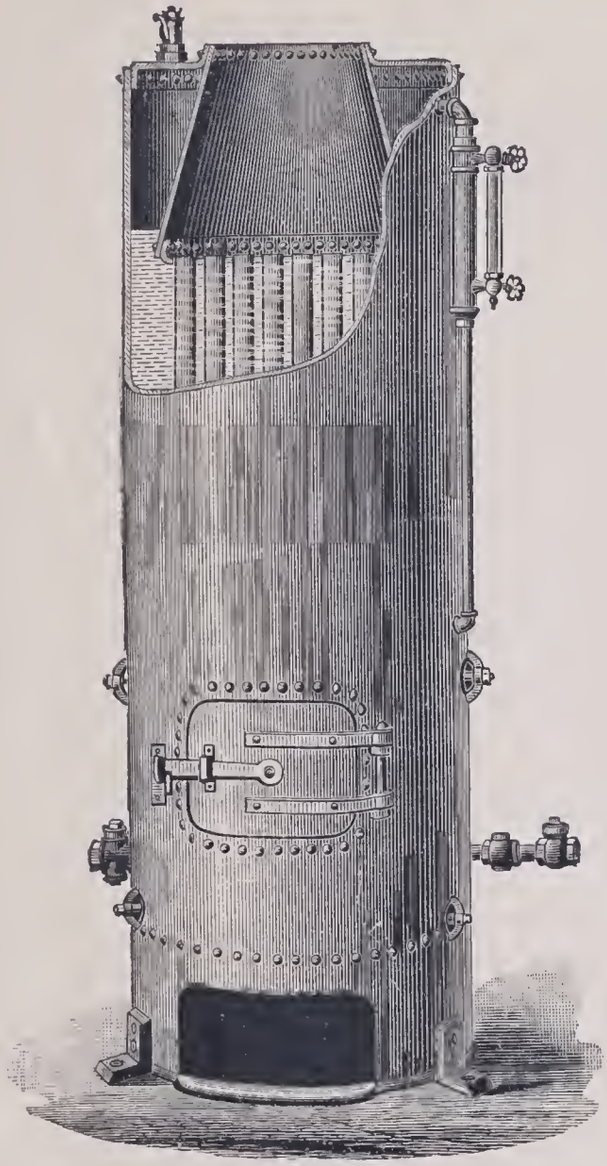
PORTABLE BOILERS MOUNTED ON WHEELS.

These boilers are the favorite "Water Bottom" style, with large steel furnace, with fusible plugs in crown sheet, and large water space around the fire, giving free circulation of the water and easy access for cleaning. *The fixtures comprise:* Grates, steam-gauge, water-gauge fitted with stand-pipe, gauge-cocks, whistle and pipe, safety-valve, blow-off-valve, check and stop-valves, smoke-stack and guys; also the tongue, but not the neck-yoke, evener, whiffletrees, brake or hand-pump, which are subject to order and are charged extra.

Number of Size	0	1	2	3	4	5	6
Horse-Power, as usually rated	6	8	10	12	15	20	25
Suitable for drill size		E or G	H	A or C	B	N	P
Diameter of boiler ..... in inches	26	28	30	32	32	34	36
Length of furnace ..... "	34	36	38	38	44	52	52
Width of furnace ..... "	21	22	24	26	26	28	30
Number of tubes, three-inch diameter	17	20	22	26	26	30	34
Length of tubes ..... in inches	60	72	78	72	78	90	96
Length of boiler over all ..... in feet	9	10½	11	10¾	12	13½	14
Weight of boiler and fixtures mounted, complete ..	3950	4550	5100	5400	5800	7050	7900

Prices on Application.

VERTICAL BOILERS, WITH SUBMERGED TUBES.



These boilers have steel furnaces, and the longitudinal seams of the shells in No. 6, and larger, are double riveted. Boilers 24, 30 and 36 inches diameter have *two*, and all larger sizes *three*, *hand holes* in the water-leg around the fire, and the *same number* over the crown-sheet.

The fixtures comprise: Base, grates, steam-gauge, water-gauge, gauge-cocks, safety-valve, blow-off-valve, check and stop-valves.

These boilers are furnished with cast-iron base-plate, unless otherwise specified. The extended shell, with ash-pan, as shown in cut, will be furnished when specified, at the same price as for the cast-iron base.

Number of Size	**4**	**5**	**6**	**7**	**8**	**9**	**10**
HORSE-POWER, as usually rated	8	10	12	15	18	20	25
Diameter of boiler ....in inches	30	30	36	36	36	42	42
Height of boiler, shell not extended ....in feet	6	6½	6½	7	8	7½	8
Diameter of furnace ....in inches	25	25	31	31	31	37	37
Length of tubes .... "	27	33	33	39	51	39	45
Number of tubes, all two-inch diameter	55	55	77	77	77	109	109
Square feet heating surface .... about	83	98	133	155	196	215	244
Weight of boiler, complete ....about	2100	2250	2950	3100	3350	4100	4300

PRICES ON APPLICATION.

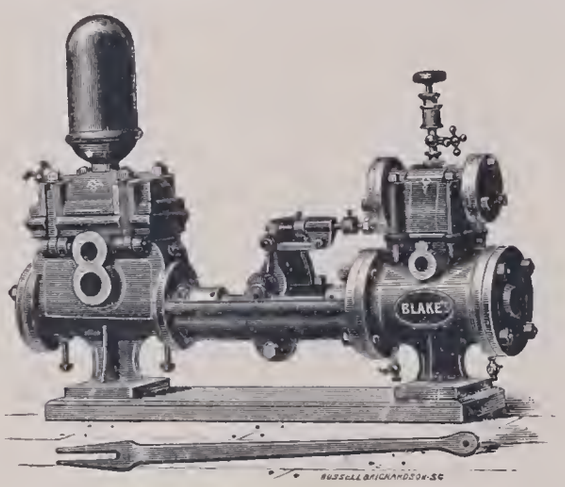
"EUREKA" SECTIONAL BOILER.—SEE PAGE 39.

STEAM PUMPS.

FOR BOILER FEEDING, DRILLING AND GENERAL MINING PURPOSES.

We are agents for the sale of the following makes of Steam-Pumps, and carry several sizes in stock, and can supply others at short notice. All these pumps are constructed with composition piston-rods, stuffing-boxes, valve-seats, valve-bolts and pump-cylinder linings. They all have large direct water passages and full valve areas, which admit of a speed that makes them very efficient FIRE-PUMPS.

BLAKE'S IMPROVED BOILER FEED OR PRESSURE PUMPS.



SIZES AS FOLLOWS:

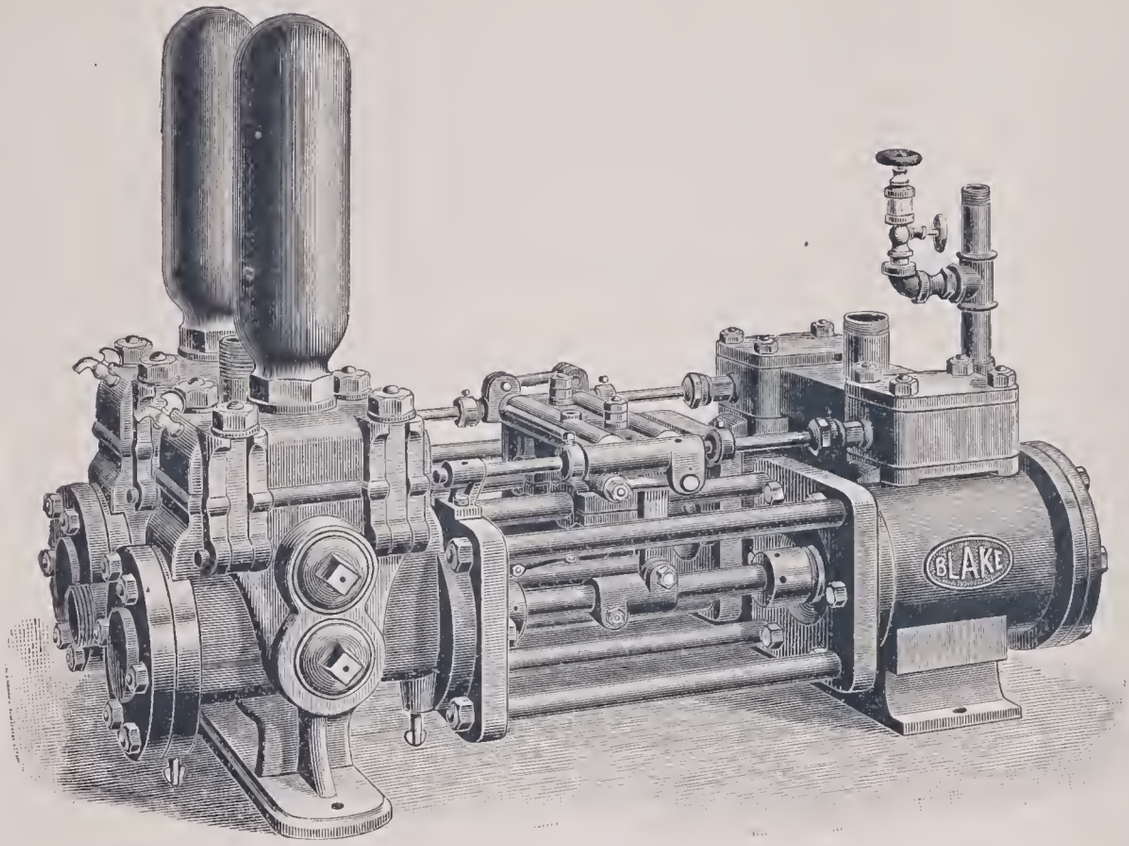
No.	Steam Cylinder.	Water Cylinder.	Stroke.	*Capacity per Minute at Ordinary Speed.	Steam Pipe.	Exhaust Pipe.	Suction Pipe.	Delivery Pipe.
0	3½	2⅛	3	150 Strokes 6 Gallons	⅜	½	1	¾
1½	4	2⅜	5	150 " 15 "	½	¾	1¼	1
2½	4½	2¾	6	150 " 22 "	½	¾	1¼	1
3	5½	3¼	7	125 " 31 "	½	¾	1½	1¼
4	6	3¾	7	125 " 42 "	¾	1	2	1½
4½	6½	4⅛	8	125 " 58 "	¾	1¼	2½	2
5	7¼	4½	10	100 " 69 "	1	1½	2½	2
6	8	5	10	100 " 85 "	1	1½	3	2½
6½	8	5	12	100 " 102 "	1	1½	3½	3
7	10	6	12	100 " 147 "	1¼	2	3½	3
8	12	7	12	100 " 200 "	1½	2½	5	4
9	14	8	12	100 " 261 "	2	3	5	4

* Twice the above capacities can be had in emergencies; but for continuous work, such as boiler-feeding, we advise about half the speeds stated.

PRICES GIVEN ON APPLICATION.

Special No. 1½ Pump with extra large (4½ inch) steam-cylinder; other dimensions same as regular No. 1½.

Blake's Special High Pressure Duplex Pumps.



Steam Cylinders Inches.	Water Cylinders Inches.	Stroke. Inches.	Strokes per Minute of each Piston Ordinary Speed.	Capacity of Both Pistons per Minute at speed stated. Gallons.	Steam Pipe. Inches.	Exhaust Pipe. Inches.	Suction Pipe. Inches.	Delivery Pipe. Inches.
6	3	7	60 to 120	27 to 54	1	1½	2½	2½
7¼	3½	10	50 to 100	44 to 88	1½	1½	3	3
8	4	12	50 to 100	64 to 128	1½	1½	4	3½
10	5	12	50 to 100	100 to 200	2	2	5	4
12	6	12	50 to 100	147 to 294	2	2½	5	4
14	7	12	50 to 100	200 to 400	2½	3	6	5

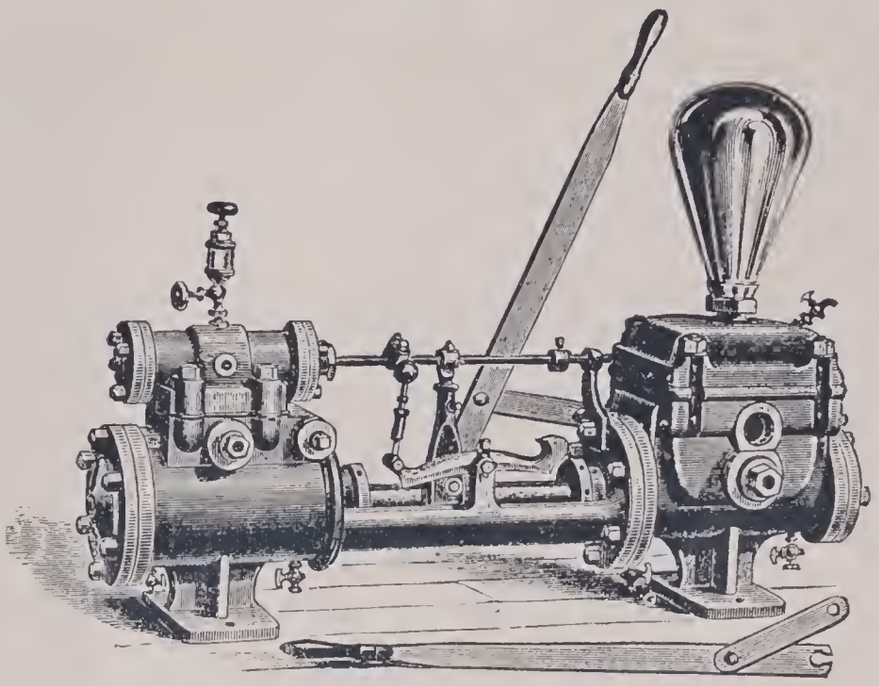
Prices given on application.

For A, B, C and N Drills, we recommend the 6 x 3 x 7 Duplex Pump, costing about $220.00.

For E, G and H Drills, we recommend the Special 4½ x 2⅜ x 5 Pump, costing about $125.00. See page 37.

For P Drill, we recommend the 8 x 4 x 12 Duplex Pump, costing about $375.00.

KNOWLES PUMP.



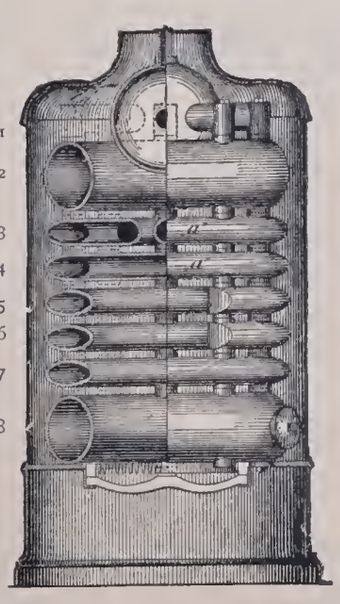
SIZES AND CAPACITIES.

No.	Steam Cylinder.	Water Cylinder.	Stroke.	Capacity per Minute at Ordinary Speed.	Steam Pipe.	Exhaust Pipe.	Suction Pipe.	Delivery Pipe.
0	3¼ in.	2 in.	4 in.	150 strokes, 7½ gallons.	½ in.	¾ in.	1¼ in.	1 in.
1	3½ "	2¼ "	4 "	150 " 10½ "	½ "	¾ "	1¼ "	1 "
2	4 "	2½ "	5 "	150 " 16½ "	½ "	¾ "	1¼ "	1 "
3	5 "	3¼ "	7 "	125 " 31 "	¾ "	1 "	2 "	1½ "
4	5½ "	3¾ "	7 "	125 " 42 "	¾ "	1 "	2 "	1½ "
4½	7 "	4 "	7 "	125 " 49 "	1 "	1¼ "	2½ "	2 "
5	7 "	4½ "	10 "	100 " 69 "	1 "	1¼ "	3 "	2½ "
6	7½ "	5 "	10 "	100 " 85 "	1 "	1¼ "	3 "	2½ "
6½	8 "	5 "	12 "	100 " 102 "	1 "	1¼ "	4 "	4 "
7	10 "	6 "	12 "	100 " 147 "	1¼ "	1½ "	4 "	4 "
8	12 "	7 "	12 "	100 " 200 "	2 "	2½ "	5 "	5 "
9	14 "	8 "	12 "	100 " 261 "	2 "	2½ "	5 "	5 "

Prices given on application.

THE "EUREKA" SAFETY BOILER.

Parties ordering Rings must mention marginal number of Ring as in this view.

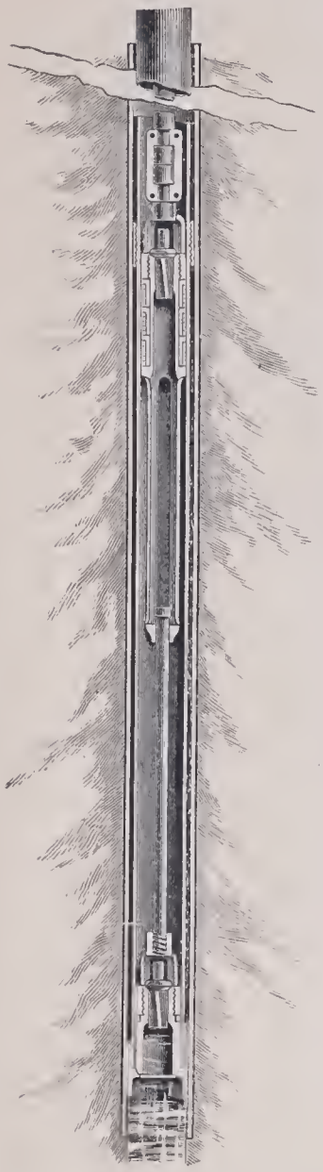


This Boiler is easily handled and moved, conveniently and cheaply repaired, economical of fuel (wood or coal), and is practically *non-explosive*.

The sections consist of hollow cast-iron rings, surrounded by a wrought-iron shell, bolted together by bolts passing through bosses, where the rings come in contact with each other. The water passes from one ring to another through these bosses, thus dividing the boiler into compartments and increasing its safety. The construction of these Boilers is such, that any crack in one of the rings acts as a safety-valve, through which the steam escapes, and prevents a disastrous explosion.

	2 Horse-Power.	4 Horse-Power.	6 Horse-Power.
Diameter, inches	22	30	42
Height, inches	52	58	84
Weight of heaviest piece, lbs.	78	135	235
Total weight, lbs.	650	1200	2000

BLAKE'S IMPROVED "ARTESIAN" WELL PUMPS.



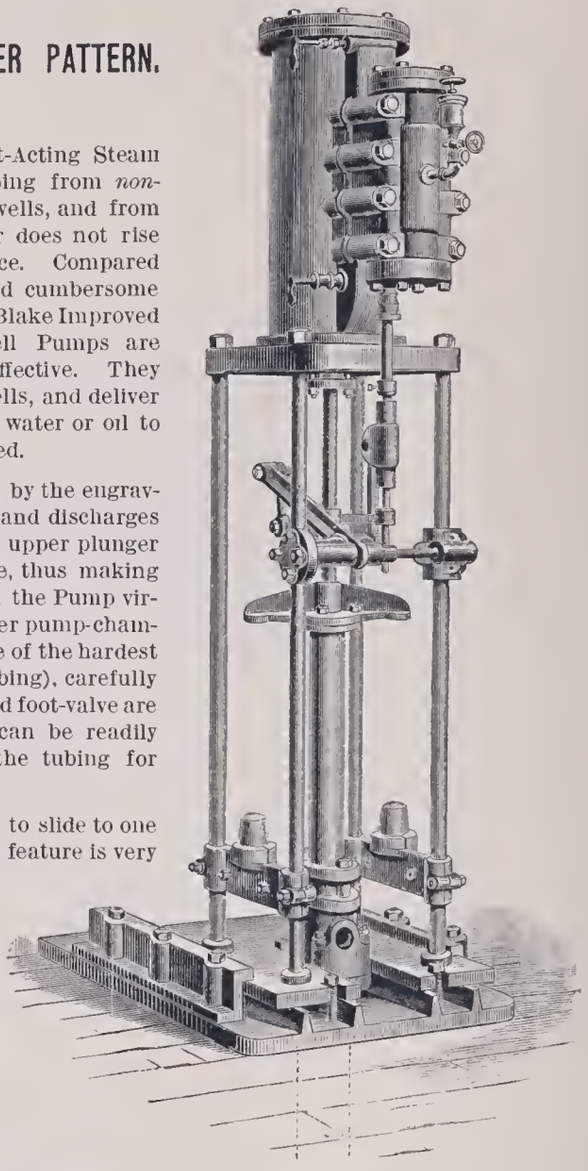
VERTICAL BUCKET-PLUNGER PATTERN.

This special form of Direct-Acting Steam Pump is designed for pumping from *non*-flowing "Artesian" or bored wells, and from driven wells where the water does not rise within 25 feet of the surface. Compared with the more complicated and cumbersome "Working-Beam" pumps, the Blake Improved Direct-Acting "Artesian" Well Pumps are simpler, cheaper and more effective. They will pump from the deepest wells, and deliver a steady, continuous stream of water or oil to any part of the premises desired.

The Pump Bucket, as shown by the engraving, is placed down the well, and discharges water on the up-stroke. The upper plunger discharges on the down-stroke, thus making the flow of water uniform, and the Pump virtually double-acting. The lower pump-chamber, or working-barrel, is made of the hardest composition (not soft brass tubing), carefully finished. The pump-bucket and foot-valve are of special construction, and can be readily drawn up together through the tubing for examination or repairs.

The steam end is arranged to slide to one side upon the bed-plate, which feature is very convenient when it is necessary to pull out the pump-rods or take up the well-piping.

The action of the pump is fully controlled by a perfected arrangement of the steam-valves, making the up and down strokes equally uniform and regular.



SIZES AND PRICES AS FOLLOWS:

Steam Cylinder.	Bucket.	Plunger.	Stroke.	Steam Pipe.	Exhaust Pipe.	Price.
4½	2¾ to 3¼	1⅞ to 2⅜	6	½	¾	.....
6	2¾ to 4¼	1⅞ to 3	12	¾	1	.....
8	3¼ to 5¾	2⅜ to 4	24	1	1½	.....
10	3¼ to 8½	2⅜ to 6	24	1¼	2	.....
12	3¼ to 8½	2⅜ to 6	24	1½	2½	.....
14	3¾ to 8½	2⅝ to 6	24	2	3	.....
16	3¾ to 8½	2⅝ to 6	24	2	3	.....

Also Patterns for larger sizes and other combinations.

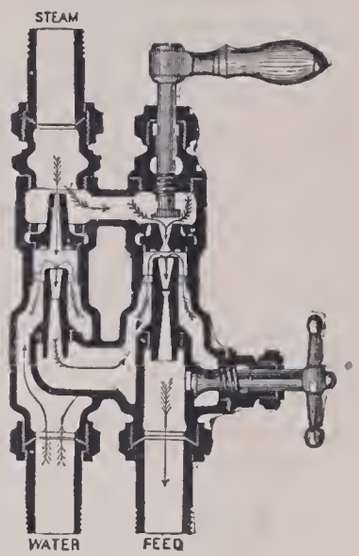
MEMORANDA.

5 inch Well will take 3 inch Pipe and 2¾ inch Bucket, or 3½ inch Casing and 3¼ inch Bucket.
5½ " " " 3½ " " " 3¼ " " 4¼ " " " 4 " "
6 " " " 4 " " " 3¾ " " 4¾ " " " 4½ " "
6½ " " " 4½ " " " 4¼ " " 5 3/16 " " " 4¾ " "
7¼ " " " 5 " " " 4¾ " " 5⅝ " " " 5 " "
8 " " " 6 " " " 5¾ " " 6⅝ " " " 6⅜ " "
9 " " " 7 " " " 6¾ " " ... " " " ... " "
10 " " " 8 " " " 7⅝ " " ... " " " ... " "

Regular Piping is more durable than Casing; the latter, however, admits of the use of larger pump-buckets, and consequently increased pumping capacity.

THE HANCOCK INSPIRATOR.

No. of Inspirator.	Size of Connections. Suction and Feed.	Steam.	Gallons per hour—60 lbs. pressure.	Horse Power.	Price List.
7½	⅜	⅜	60	6 to 8	$16.00
8¾	½	⅜	85	8 " 10	18.00
10	½	⅜	120	10 " 15	20.00
12½	¾	½	220	18 " 25	25.00
15	¾	½	300	25 " 35	30.00
17½	1	¾	430	35 " 50	40.00



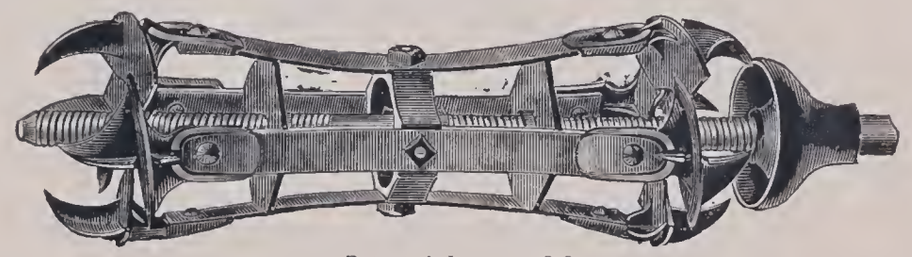
DISCOUNT .....

When ordering an Inspirator, please answer the following questions:—

1. What is the horse-power of boiler or boilers; or what is the quantity of water required per hour?
2. What is the range of steam pressure?
3. What is the temperature of supply?
4. What is the extreme lift or head, vertically or horizontally, from supply to Inspirator?
5. Is water used for other purposes than feeding boilers?
6. What is the number of boilers?
7. What type of boiler is used?
8. What are the dimensions of boilers?

BOILER FLUE CLEANER.

"ENGINEER'S FAVORITE."

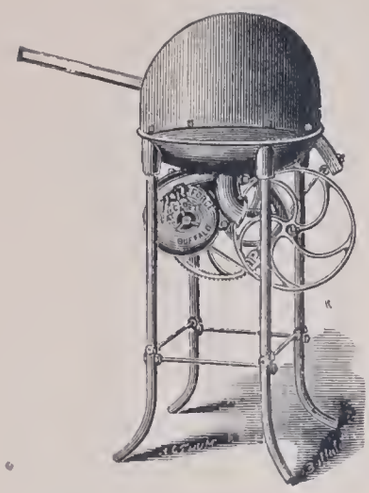


Patented Jan. 29, 1878.

Strong and durable. Can be set up *while in the tubes,* to fit tightly, or slackened down to override any uneven surface, by simply turning the rod or handle to which the Cleaner is attached. It is double-headed and double-acting.

PRICE.

For Tube,	1½	in. outside diam	....	$1	50	For Tube, 2½ in. outside diam	$2 50
"	"	1¾	"	"	 1	75	" " 3 " " 3 00
"	"	2	"	"	 2	00	" " 3½ " " 3 50
"	"	2¼	"	"	 2	25	DISCOUNT .....



EMPIRE PORTABLE FORGES.

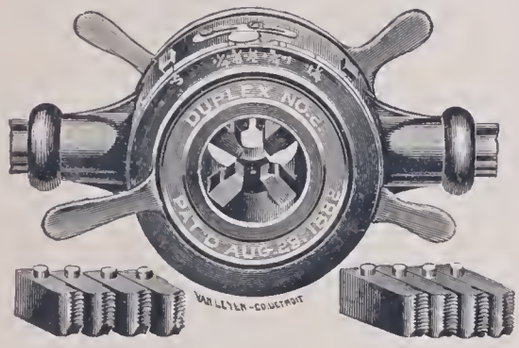
No. 10. Fire Pan, 17x19 in., Fan, 8 in., Height, 29 in., Weight, 90 lbs.....$27 00
No. 9. Fire Pan, 21x27 in., Fan, 10 in., Height, 29 in., Weight, 150 lbs..... 36 00

This Forge has Pipe-Legs and Swivel-Handle. Without Hood.

Same with Hood, No. 10. Weight, 110 lbs.....$30 00
" " " No. 9. " 160 " 40 00

DISCOUNT.....

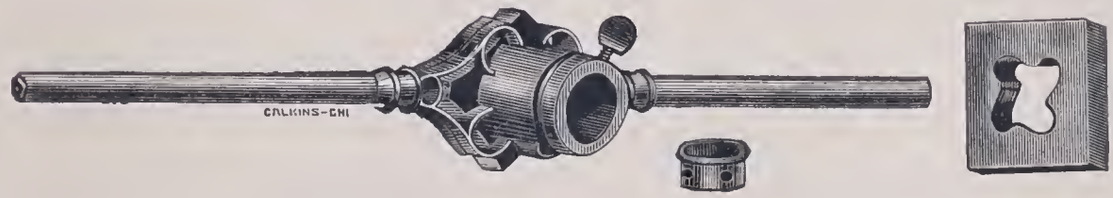
DUPLEX PIPE DIES.



No. 1.	Threading	1/8 in.	" 3/4 in. inclusive,	$13.00
No. 2.	"	1/4 in.	" 1 1/4 in. "	17.00
No. 3.	"	1 in.	" 2 in. "	22.00
No. 3½.	"	½ in.	" 2 in. "	25.00
No. 4.	"	1½ in.	" 3 in. "	40.00
No. 5.	"	2½ in.	" 4 in. "	55.00

DISCOUNT..... .....

WALWORTH STOCKS AND DIES.

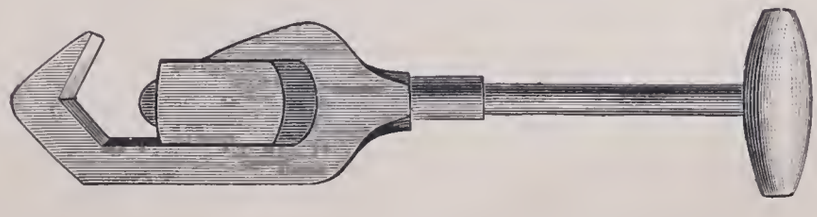


No. 0 cuts 1/8 to ½ inch, $9.50.
No. 1 cuts ½ to 1 inch, 15.00.
No. 2 cuts 1 1/4 to 2 inch, $20.00
No. 3 cuts 2½ to 3 inch, 43.00

Nos. 2 and 3 have leader screw for starting the thread.

DISCOUNT.....

STANWOOD PIPE CUTTERS.



No. 1 cuts 1/8 to 3/4 inch .....$1.50.
No. 2 cuts 3/4 to 2 inch .....2.25.
No. 3 cuts 2 to 3 inch .....7.00.

Extra Cutter Wheels.
No. 1, 12c; No. 2, 18c; No. 3, 25c.

DISCOUNT.....

BROWN'S PATENT ADJUSTABLE PIPE TONGS.

No. 1	Takes ⅛ to ¾ inch	$1 30	No. 3	Takes 1 to 2 inch	$3 00
1½	" ⅜ to 1 inch	1 65	4	" 1½ to 3 inch	6 00
2	" ½ to 1¼ inch	2 00	5	" 2½ to 4 inch	11 00

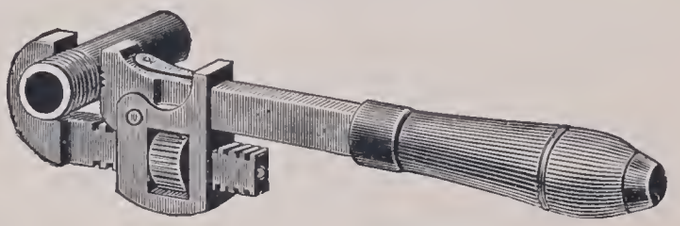
DISCOUNT.....

BROCK'S PATENT CHAIN TONGS.

No. 0.	Takes ⅛ to ¾ in	$2 50	No. 3.	Takes ¾ to 4 in	$7 50
1.	" ⅛ to 1½ in	3 50	4.	" 1½ to 8 in	11 00
2.	" ¼ to 2½ in	5 50	5.	" 2 to 14 in	18 00

DISCOUNT.....

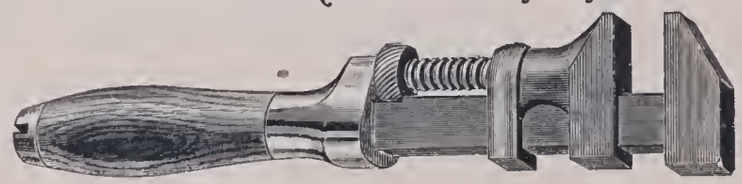
STILLSON'S PATENT PIPE WRENCHES.



Length, open,	6	inch,	takes	⅛	inch	wire	to	½	inch	Pipe		$2.00
"	"	8	"	"	⅛	"	"	"	¾	"	"	2.00
"	"	10	"	"	⅛	"	"	"	1	"	"	2.25
"	"	14	"	"	¼	"	"	"	1½	"	"	3.00
"	"	18	"	"	¼	"	"	"	2	"	"	4.00
"	"	24	"	"	¼	"	"	"	2½	"	"	6.00

DISCOUNT.....

COE'S SCREW WRENCHES.



Size in inches	6	8	10	12	15	18	21
Price	$ 75	.83	1.00	1.17	2.00	2.50	3.00

DISCOUNT.....

JACK SCREWS.

Diameter of Screw, Inches.	Height over all, Inches.	List Price.	Diameter of Screw, Inches.	Height over all, Inches.	List Price.
1½	8	$3 50	2	24½	$11 50
1½	16	5 25	2½	16	9 75
1½	20	6 75	2½	24	14 50
2	12½	6 00	2½	38	26 00
2	18½	8 25	3	24	22 00

DISCOUNT..... OTHER SIZES IN STOCK.

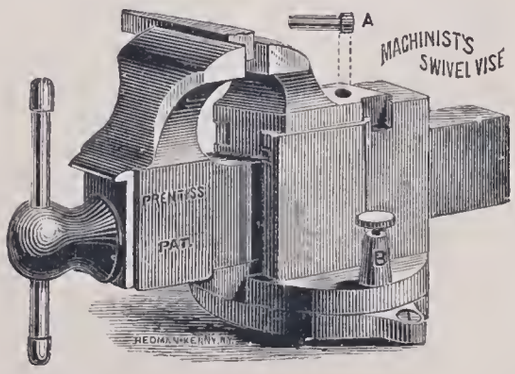
BELL BASE RATCHET JACKS.

Diam. of Screw, Inches.	Height over all, Inches.	List Price.	Diam. of Screw, Inches.	Height. over all, Inches.	List Price.
2	18	$25 25	2½	24	$31 75
2	24	28 25	2½	36	42 50
2	30	31 25	3	20	43 00
2½	18	28 00	3	36	61 00

DISCOUNT..... OTHER SIZES IN STOCK.

PRENTISS' PATENT VISES.

WITH SWIVEL BASE AND JAW.

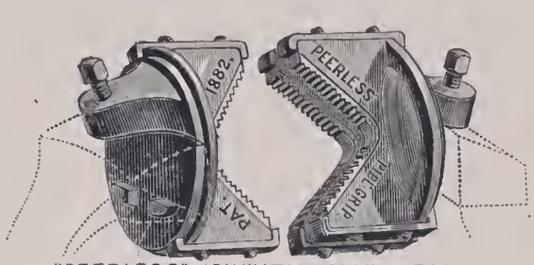


Width of Jaw 2⅝ inches, opens 3½ inches..... $ 6.75
" " 3½ " " 4¾ " 8.50
" " 4½ " " 6 " 12.50
" " 5¼ " " 8 " 19.00
" " 6 " " 9 " 27.00

DISCOUNT.... .....

' PEERLESS'' PIPE GRIP.

ADAPTED TO ANY VISE. ADJUSTS ITSELF TO WHATEVER ANGLE THE OBJECT HELD MAY REQUIRE.

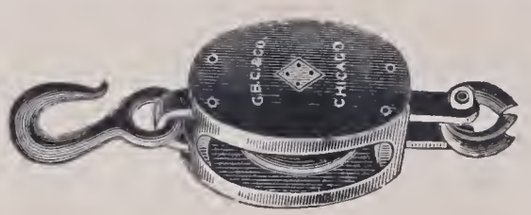


"PEERLESS" *(SWIVEL)* PIPE GRIP.

No. 1, For 3 in. to 4¾ in. Vise, Holds ¼ in. to 2 in. pipe.....$4.50
No. 2, " 5 " 7 " " " ½ " 5 " 6.00

DISCOUNT.....

HARCOURT'S PATENT BLOCKS.



Shell	4	in. diameter, for	½	in. Rope;	Single.....	$0.70	Double....	$1.25
"	6	" "	¾	" "	.....	1.10	"	2.00
"	7	" "	⅞	" "	.....	1.30	"	2.40
"	8	" "	1	" "	.....	1.65	"	2.85
"	10	" "	1⅛	" "	.....	2.50	"	4.25

DISCOUNT.....

OTHER SIZES—ALSO TRIPLE BLOCKS—FURNISHED FROM STOCK.

DRIVE PIPE.

WITH SPECIAL LONG THREADS AND PATENT COUPLINGS!

In pieces about ten feet long, threaded so that ends of pipe butt together when screwed up.

NET PRICES GIVEN ON APPLICATION.

Nominal Inside Diam. Inches.	Actual Inside Diam. Inches.	Outside Diameter. Inches.	Diameter of Coupling. Inches.	Weight per Foot. Lbs.	Threads to Inch.
3	3.06	3.50	$4\frac{7}{32}$	7.54	8
3½	3.56	4.00	$4\frac{11}{16}$	9.00	8
4	4.02	4.50	$5\frac{9}{32}$	10.66	8
4½	4.50	5.00	$5\frac{25}{32}$	12.34	8
5	5.04	5.56	$6\frac{13}{32}$	14.50	8
6	6.06	6.62	$7\frac{13}{32}$	18.76	8
7	7.02	7.62	$8\frac{13}{32}$	23.27	8
8	7.98	8.62	$9\frac{19}{32}$	28.18	8

LAP AND BUTT WELDED WROUGHT IRON PIPE.

	Nominal Inside Diameter. Inches.	Actual Inside Diameter. Inches.	Thickness. Inches.	Outside Diameter. Inches.	Diameter Coupling. Inches.	Weight Per Foot. Lbs.	Number Threads to Inch.	Price Per Foot.
Butt-Welded.	⅛	.27	.07	.40	.60	.24	27	$ .04
	¼	.36	.08	.54	.78	.42	18	.04
	⅜	.49	.09	.67	.91	.56	18	.04
	½	.62	.10	.84	1.10	.84	14	.05
	¾	.82	.11	1.05	1.34	1.12	14	.07
	1	1.04	.13	1.31	1.66	1.67	11½	.09½
	1¼	1.38	.14	1.66	2.00	2.24	11½	.12½
Lap-Welded.	1½	1.61	.14	1.9	2.28	2.68	11½	.22
	2	2.06	.15	2.37	2.81	3.61	11½	.28
	2½	2.46	.20	2.87	3.28	5.74	8	.44
	3	3.06	.21	3.5	4.02	7.54	8	.58
	3½	3.56	.22	4.	4.50	9.00	8	.70
	4	4.02	.23	4.5	5.10	10.66	8	.85
	4½	4.50	.24	5.	5.53	12.34	8	1.00
	5	5.04	.25	5.56	6.25	14.50	8	1.20
	6	6.06	.28	6.62	7.34	18.76	8	1.65
	7	7.02	.30	7.62	8.34	23.27	8	2.00
	8	7.98	.32	8.62	9.44	28.18	8	2.75
	9	9.00	.34	9.68	10.47	33.70	8	3.70
	10	10.01	.36	10.75	11.50	40.06	8	4.75
	11	11.	.37	11.75	.....	45.02	8	5.75
	12	12.	.37	12.75	13.78	49.00	8	6.50

DISCOUNT.....

LIGHT WROUGHT-IRON

ARTESIAN, SALT, OIL AND GAS WELL CASING.

Fitted with either Patent Protecting Sleeve Couplings, Inserted Joints or Flush Joints.

Inside Diameter. Inches.	Outside Diameter. Inches.	Largest Diameter Patent Coup'g. Inches.	Largest Diameter Inserted Joint. Inches.	Weight Per Foot. Lbs.	Treads To Inch.	Price Per Foot.
2	2¼	2 21/32	2½	2.23	14	$ .25
2¼	2½	3 1/32	2¾	2.75	14	.28
2½	2¾	3 13/32	3	3.00	14	.31
2¾	3	3 25/32	3¼	3.33	14	.34
3	3¼	3 29/32	3½	3.95	14	.38
3¼	3½	4 3/32	3¾	4.27	14	.43
3½	3¾	4 13/32	4	4.60	14	.45
3¾	4	4 19/32	4¼	5.33	14	.52
4	4¼	4 27/32	4½	5.50	14	.56
4¼	4½	5 3/32	4¾	6.00	14	.60
4½	4¾	5⅜	5	6.50	14	.66
4¾	5	5 19/32	5¼	7.25	14	.72
5	5¼	5 27/32	5½	7.66	14	.79
5 3/16	5½	6 5/32	5¾	8.08	14	.86
5⅝	6	6 19/32	6¼	9.35	14	1.00
6¼	6⅝	7 3/16	6⅞	10.06	14	1.30
6⅝	7	7 19/32	7¼	12.45	14	1.45
7¼	7⅝	8 7/32	7⅞	13.50	14	1.70
7⅝	8	8⅝	8¼	15.10	11½	1.85
8¼	8⅝	9 5/16	8⅞	16.15	11½	2.10
8⅝	9	9¾	9⅜	17.25	11½	2.25
9⅝	10	10¾	10⅜	19.00	11½	2.75

DISCOUNT.....

PRICE LIST

—OF—

SPECIAL TOOLS AND SUPPLIES.

Following are the price lists of our special makes of casing, drilling tools, recovering taps, etc. The prices on all these goods are net, with *no discount.*

In examining these lists it should be borne in mind that—

"A" Rods, Reamers, Taps, Bits, Core Barrels, etc. are used with A, C and H Drills
"B" " " " " " " " " " B "
"E" " " " " " " " " " E and G "
"M" " " " " " " " " " M "
"N" " " " " " " " " " N and P "

FLUSH JOINT CASING. Fig. 18, page 31.

This casing has perfectly smooth joints, and offers the least possible resistance to being pulled out. It is made of extra heavy pipe, threaded in a lathe, and is strong and durable, and excellent in every way. It is threaded *left-handed* to prevent it from unscrewing while the drill is running, and so that it can be "backed off" in the hole by a tap screwed to the ordinary drill rods. Casing which is threaded *right-handed* necessitates pinning all joints in the rods, in order to back it off, and is sometimes unscrewed by the friction of the rods in drilling.

Nominal Inside Diameter. Inches.	Actual Inside Diameter. Inches.	Thickness. Inches.	Actual Outside Diameter. Inches.	Weight Per Foot. Lbs.	No. of Square Threads to Inch.
2	1.93	.22	2.37	5.00	4
2½	2.31	.28	2.87	7.67	4
3	2.89	.30	3.50	10.25	4
3½	3.35	.32	4.00	12.47	4
4	3.81	.34	4.50	14.97	4

LENGTH ABOUT 10 FT. PRICES ON APPLICATION.

PROTECTORS FOR FLUSH JOINT CASING. Fig. 18, page 31.

Size of Pipe	2	2½	3	3½	4
Price per pair	$ .40	.52	.65	.78	.90

DRIVE HEADS AND SHOES. Fig. 6, page 27.

Size Pipe, inches,	2	2½	3	3½	4	4½	5	6	8
Price each	$5.00	6.25	7.50	8.75	10.00	11.25	12.50	15.00	20.00

REAMERS. See Fig. 16 and Description, on Page 31.

Besides those described, we make several special styles, with extra long guides, extra long followers, etc., applicable to use in special cases. We can furnish any of these promptly, from stock or to order. In ordering *be sure to specify* size of guide, size of hole to be reamed, and size of drill-rods to be used with the reamer.

Prices given on application.

RECOVERING TAPS. Made of special Tool Steel, and properly tempered. In ordering Taps, state size of rods or casing to be pulled and kind of threads on rods or casing by which the Tap is to be lowered.

TAPER-TAPS. RIGHT OR LEFT HAND. FIG. 19, PAGE 32.

Size Rods	A	B	E	M	N
Price	$13.00	13.00	11.00	11.00	14.00

COUPLING TAPS. RIGHT OR LEFT HAND. FIG. 20, PAGE 32.

Size Couplings	A	B	E	M	N
Price	$3.00	3.00	3.00	3.00	4.00

HOLLOW TAPS. RIGHT OR LEFT HAND. FIG. 21, PAGE 32.

Size Rods	A	B	E	M	N
Price	$11.00	11.00	10.00	10.00	12.00

CASING RECOVERING TAPS. TAPER. (SAME AS TAPER ROD RECOVERING TAPS.)

Size Casing, right or left hand	2 in.	2½ in.	3 in.	4 in
Price	$14.00	16.00	20.00	31.00

BLANK BITS. FIG. 8, PAGE 28, SHOWS BIT SET WITH DIAMONDS.

Size	A	B	E	M	N
Diameter, inches	1¾	2	1½	1¾	2¾
Price per doz.	$15.00	15.00	12.00	15.00	21.00

Special sizes for casing core barrels furnished at short notice. In ordering special sizes state outside and inside diameter of bit, and size and kind of casing it is to be used with.

CORE SHELLS. FIG. 9, PAGE 28.

Size	A	B	E	M	N
Price each	$3.25	3.25	3.25	3.25	5.00
Special "No. 663" Core Shell					5.50

CORE LIFTERS. WITH SPRING JAW.

Size	A	B	M
Price each	$3.50	3.50	3.50

"COSSETTE" CORE LIFTERS. WITH LOOSE JAW AND STEEL SPRING. FIG. 10, PAGE 28.

Size	A	B	M	N
Price each	$3.80	3.80	3.80	6.25
Extra Jaws, each	.26	.26	.26	.26
Extra Springs, each	.06	.06	.06	.06

"E" SPRING STEEL CORE LIFTERS.

Specially designed for the small "E" Core. Price each, ... $1.00.

SPECIAL NO. 663 CORE LIFTER. WITH INVERTED SPRING STEEL JAWS.

For "N" Rods, used with No. 663 Core Barrell and Shell.

Price each $7.50

Extra Spring Jaws, each ..... .50

CORE BARRELS.

Size	A	B	E	E	E	M	N
Length	10 ft.	10 ft.	10 ft.	5 ft.	20 in.	10 ft.	10 ft.
Price each	$14.00	20.00	12.50	10.00	7.00	14.00	37.50

SPECIAL NO. 663 CORE BARREL. See page 32.

Core Barrel, with cage, spring piston and wires, each ..... $....

SETTING BLOCKS for holding Blank Bits while Setting the Diamonds.

Size	A	B	E	M	N
Price, each	$1.25	1.25	1.25	1.25	1.50

DRILL-RODS WITH COUPLINGS.

Size	A	B	E	M	N
Outside diameters, inches	1 5/8	1 13/16	1 5/16	1 3/8	2 3/8
Length, feet	10	10	5	5	10
Weight per 100 ft., boxed	340	380	360	250	550
Price per 100 feet	$69.50	75.50	72.50	60.00	95.00
Extra Couplings, each	1.25	1.25	1.00	1.00	1.50

Note.—A rods are used with A, C and H Drills; E rods are used with E and G Drills; N rods are used with N and P Drills.

BUSHINGS FROM DRILL-RODS TO CASING.

Any size Rods. Diam. of Casing	2 in.	2½	3	3½	4
Price each	$3.00	3.50	4.25	5.25	6.75

CHOPPING BITS. with two crossed cutting edges, as in Fig. 7, Page 27.

Threaded for Drill-Rods.

Size of Drill-Rod	A	B	E	M	N
Length, Cutting Edge, inches	1¾	2	1½	1¾	2¾
Price each	$6.25	7.50	6.25	6.25	12.00

CHOPPING BITS. with single cutting edge.

In ordering, give size of casing the bit is to be screwed into, or diameter of screw and number of threads to inch, as well as length of cutting edge of bit.

Length of Cutting Edge, inches	2¾	3⅜	3⅞	4⅜	4⅞	5⅞	7⅞
Used inside Casing of nominal inside diameter, inches	3	3½	4	4½	5	6	8
Price, each	$6.25	7.00	7.25	7.50	9.00	11.25	15.60

PIPE CLAMPS. Fig. 17, Page 31.

Size of Pipe, in.	2	2½	3	3½	4	4½	5	5½	6	8
Price	$3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	9.00

SHEAVE WHEELS, with Strap and Hook.

Size of Drill	A	B	H	N	P
Price, complete	$10.25	17.50	10.25	17.50	30.00

DRIVE-CHUCKS. See "L" Fig. 4, Page 9.

Size of Drill	A or C	B	E	H	N	P
Price, complete	$15.60	21.90	15.60	15.60	35.00	45.00
Extra Jaws	3.12	3.12	3.12	3.12	5.62	7.50

SAFETY-CLAMPS. Fig. 12, Page 29.

Size of Drill	A or C	B	E or G	H	M	N	P
Price, complete, each	$17.00	50.00	17.00	17.00	17.00	50.00	50.00
Extra Jaws, stationary	3.12	7.59	3.12	3.12	3.12	7.50	7.50
" " swinging	5.00	20.00	5.00	5.00	5.00	20.00	20.00

LIFTING BALE AND CLEVIS. Fig. 14, page 30.

Size of Rods	A	B	E	M	N	P
Price, each, consisting of Bale and Clevis	$3.50	5.00	3.50	3.50	5.00	5.00

LIFTING-SWIVELS OR HOISTING-PLUGS. Fig. 11, Page 29.

Size of Rods	A	B	E	M	N
Price, each	$8.00	8.00	6.00	6.00	10.00

WATER-SWIVELS. Fig. 13, Page 29.

Size of Rods	A	B	E	M
Price, each	$10.00	12.00	8.00	8.00

IMPROVED WATER-SWIVELS. Fig. 15, Page 30.

Size of Rods	A	B	N
Price, each	$10.00	$12.00	$40.00

HORSE-POWERS.

By means of a "Horse-Power" the "M" Drill can be used to a depth of 400 or 500 feet. Price of Horse-Power, with Jack and Belt.....$55.00

FRAME FOR "E" DRILL, SURFACE WORK. See Page 8 and Cut, Page 16.

This is not necessary to the successful operation of the Drill, but as the "E" was designed for under-ground prospecting, it is found more convenient to use the frame where much surface work has to be done.

Price of Frame, complete, with Clamps and Bolts for holding Drill to Frame and Frame to floor.....$70.00

Weight of Frame about 250 pounds.

MISCELLANEOUS.

Besides the above, we can furnish any of the following, promptly, at the lowest market rates: Levels, Pressure-Gauges, Hack-Saws, Hammers, Breast-Drills and Bits, Screw-Drivers, Tape-Lines, Hose-Clamps, Files, Packing, Waste, Oil-Cans, Boiler Fittings, Wire Rope, Shovels, Picks, Axes, Saws, Crowbars, Chisels, Grind-stones, Lanterns, and all Drill Runners', Machinists' and Blacksmiths' Tools and Supplies.

TESTIMONIALS.

We give below a number of testimonials, showing the favor with which the SULLIVAN DIAMOND PROSPECTING DRILLS have been received, and the satisfactory results of our contract prospecting work. These letters are from widely separated parts of the country, where the drills have been used in prospecting for many different minerals, in very different kinds of material, and under varying conditions:

"B" DRILL ON THE VERMILION RANGE.

MINNESOTA IRON COMPANY, MANAGER'S OFFICE,
SOUDAN, MINN., October 1, 1888.

Messrs. Diamond Prospecting Co., 74 and 76 West Lake St., Chicago, Ill.

GENTLEMEN: Would say in reply to yours of the 27th, that the "B" Drill has been in almost continuous use since its arrival, and has given excellent satisfaction

Yours truly, D. H. BACON, *Manager.*

———o———

"N" AND "P" DRILLS IN ILLINOIS AND BRITISH COLUMBIA.

W. H. HOLCOMB, Pres.
Portland, Oregon.

JOHN KANGLEY, Sup't.,
Streator, Ill.

STAR COAL CO.
STREATOR, ILL., January 18, 1889.

Diamond Prospecting Co., Chicago, Ill.

DEAR SIRS: Answering yours of the 16th, requesting my opinion on the SULLIVAN DIAMOND CORE DRILLS. Last summer I purchased of you an "N" and a "P" Drill. I have been using the "N" Drill in Northern Illinois, and the "P" Drill in Washington Territory, and also on Vancouver Island, B. C., where it is now running.

I have found the working of these machines to be very satisfactory. They are well built, and do their work very efficiently.

Yours truly, STAR COAL CO.,
JOHN KANGLEY, *Gen. Manager.*

———o———

ECONOMY AND SAVING OF CARBON WITH "G" DRILL.

OFFICE OF
REPUBLIC IRON CO.
REPUBLIC, L. S., MICH., January 18, 1889,

F. K. Copeland, Esq., Vice-President.

DEAR SIR: Yours of the 16th received. I am sorry that I have not at hand any statistics that I could send with this letter, showing the work done by the "G" Drill we purchased of you over two years ago. Will say now, that the Drill has been in almost constant use ever since, and is still in use and doing excellent work. We have done all of our underground exploring with it, and have been very successful in locating ore bodies. It is remarkably easy on carbons; one man sets bits and does all the drilling. I showed your letter to Capt. Pascoe, our Mining Superintendent, and he said, "Tell him it is the best machine for underground exploring I ever saw. Ours has paid for itself ten times over. With this Drill, prospecting can be done underground at less cost than by any other way." Our holes are from 50 to 150 feet deep.

Yours truly,
GEO. WILSON, *Agent.*

———o———

"E" DRILL IN THE NEW JERSEY IRON MINES.

OFFICE OF
WEST END IRON COMPANY,
P. O., Valley, Hunterdon Co., N. J.
WEST END, N. J., August 24, 1888.

Diamond Prospecting Co., Chicago, Ill.

DEAR SIRS: The "E" SULLIVAN DIAMOND DRILL, purchased of you last April, has been in constant use, having bored about 1,300 feet through gneiss rock, the holes ranging from 75 to 200 feet deep each, and at all angles. Our work has been all underground, and mostly drifts four feet wide by six high.

We have found it all that it is recommended to be; easy to transfer and set up, and simple to operate, and has given us entire satisfaction. Very truly yours,

WEST END IRON CO., *O. J. Conley, Supt.*

"A" and "B" DRILLS.

DENVER, COL., November 4, 1884.

F. K. Copeland, Esq., General Agent of the Diamond Prospecting Co., Chicago.

DEAR SIR: Acknowledging receipt of your note of inquiry, I take pleasure in assuring you of my entire satisfaction with the work done by your Company with the SULLIVAN DRILL upon lands in which I am interested in this State.

The greatest depth attained was twelve hundred and one-half feet. At this point your "B" Drill was used, and had I desired you to do so, I have no doubt you could have drilled to a much greater depth. At another point where your "A" Drill was employed, a depth of one thousand and seventeen feet was attained. At both points the strata varied in hardness, from a very close compact rock to unsolidified matter. At five other points drill holes were sunk, ranging from three hundred and fifty to something over eight hundred feet in depth. The core removed gave in each case as perfect an idea of the geological structure and of the character of the different strata encountered, as could have been obtained by sinking a shaft. Very truly yours, CHARLES H. TOLL.

—o—

"G" DRILL IN DAKOTA.

SETH BULLOCK, Prest.
D. A. MCPHERSON, Sec'y.

OFFICE OF
THE IRON HILL MINING COMPANY,
DEADWOOD, DAKOTA, January 3, 1888.

Diamond Prospecting Co., Chicago, Ill.

GENTLEMEN: The Diamond Drill purchased from you by this Company has been in almost continuous use for the past fourteen months, and has given complete satisfaction, saving to the Company many times its original cost. For defining ore bodies, and prospecting ground, it is certainly an indispensable adjunct to every well-equipped mine. The entire expense of operating it does not exceed $4.25 per diem, and we have run as high as eighty feet in a day through reasonably tight ground. The mechanism of your Drill is so simple that almost any man, of fair intelligence, can run one after seeing it in operation a few times, and there are no complicated parts to be continually getting out of repair. Our Drill is seemingly in as good condition as when purchased, and its repair account for the fourteen months that it has been in use does not amount to ten dollars.

Yours, etc. SETH BULLOCK, *President Iron Hill Mining Co.*

—o—

MICHIGAN IRON MINES.

OFFICE OF THE
SAGINAW MINING CO.
STONEVILLE, MARQUETTE COUNTY, MICH., November 8, 1884.

F. K. Copeland, Gen. Agt.

DEAR SIR: Yours of October 31st received, and contents noted. In reply would say that we have used the Sullivan Core Drilling Machine for two years and a half, and have drilled holes from 300 to 1,000 feet deep, and through all kinds of ground—some very hard and some quite loose and soft—and it has given entire satisfaction in all cases. The last hole we drilled with it was 915 feet vertical, and it handled the rods without any difficulty. I can cheerfully recommend it to any person in need of drilling machines. Yours truly, NATIONAL IRON MINE,
SAMUEL MITCHELL, *Agent.*

—o—

"G" DRILL in JASPER.

SUPERINTENDENT'S OFFICE OF THE WEST REPUBLIC MINING COMPANY,
REPUBLIC, MICHIGAN, September 8, 1886.

F. K. Copeland, Secretary Diamond Prospecting Co., Chicago, Ill.:

DEAR SIR: In reply to your favor of August 12th, asking me to state rate of drilling done by the "G" drill bought of you, I am pleased to say that the drill has, and is, giving *perfect satisfaction.* Since hearing from you I have kept track of actual drilling done. In ore we have drilled at the rate of one inch per minute, running twenty inches in twenty minutes. In jasper we are averaging fifteen feet in shift of nine hours. Record of one hole, part ore and part jasper, was 72 feet in 36 hours, running through 65 feet of jasper and 7 feet of ore. The drill has been a great help to me in laying out work, and I am pleased to give you our experience, and hope it will be of service to you.

Yours truly, J. O. ST. CLAIR, *Superintendent.*

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"E" DRILL—FEW REPAIRS.

OFFICE OF
COFFIN & WARREN,
DULUTH REAL ESTATE, ETC.,
DULUTH MINN., Dec. 31, 1888.

Mr. F. K. Copeland, Vice-President, Chicago, Ill.:

DEAR SIR. I have used one of your smaller sized drills for eight months, and while I regret I did not buy a larger size, I am more than satisfied with the drill. The drill has worked day in and out with hardly a stop (except when moving), for the whole time, and with hardly a cent expended for repairs. Though an "E" Drill we have made 19 feet a day (of 24 hours) and worked in every kind of rock found on the range, and to our satisfaction. I commend it to all who wish to buy.

Yours truly, H. W. COFFIN,
Secretary Consol. Vermil. I. & L. Co.

SUPERIORITY OF THE "E" DRILL.

DULUTH, MINN., August 19, 1887.

F. K. Copeland, Secretary, Chicago.

DEAR SIR: Referring to yours of August 16, will say that I believe your "E" Drill is the best made. I bought it with that belief, and I have not been disappointed.

Mr. Cole, of Tower, Minn., who has given your Drill the severest tests, told me he thought it superior to any Drill made. His recommendation would go further than mine.

Yours truly, G. C. GREENWOOD,
Secretary and Treasurer D. I. M. & D. Co.

———o———

"B" DRILL IN ILLINOIS COAL FORMATIONS.

MUDDY VALLEY MINING AND MANUFACTURING COMPANY,
POST OFFICE, ELKVILLE, ILL.
MUDDY VALLEY, ILL., January 3, 1889.

Diamond Prospecting Co., Chicago, Ill.

GENTLEMEN: Yours of the 31st received, and in reply would say we have used one of your "B" Drills for the last two years, and during that time have done all kinds of work with it; and have found it entirely satisfactory in every way. Yours truly,

MUDDY VALLEY MINING AND MANF'G CO.
Per JOHN FORESTER.

———o———

"E" DRILL IN THE MICHIGAN IRON MINES.

PITTSBURG & LAKE SUPERIOR IRON CO.
JOSEPH KIRKPATRICK, Agent.
PALMER, Marquette Co., MICH., December 31, 1888.

F. K. Copeland, Esq., Vice-President.

DEAR SIR: Your favor of the 29th inst. is at hand. The Drill we purchased from your company last October has been in active use in our mines ever since. Our superintendent is very well pleased with it, and I feel that it would be proper to recommend it to any company desiring to explore their underground workings, as we are doing Indeed, we think had we purchased a year sooner it would long since have paid for itself. Our superintendent is now absent at Cleveland, and will be home on Friday of this week, and if you desire anything more said I will have him write you.

Very truly, etc., JOS. KIRKPATRICK, *Agent.*

———o———

PREFERENCE FOR SULLIVAN DRILLS.

COPPERFIELD MINING AND SMELTING COMPANY.
WORKS AT COPPERFIELD, VT.
MINE CONTRACTOR'S OFFICE, P. O. WEST FAIRLEE, VT., January 3, 1889.

C. B. Rice, Treasurer Sullivan Machine Co., Claremont, N. H.

DEAR SIR: I have your favor of Jan. 1, in which you ask if I will express my opinion of the DIAMOND PROSPECTING DRILLS made by your company.

I have used your "B" Drill for explorations from the surface, testing for minerals in the Laurentian Gneisses of New York, and the sandstones, slates and conglomerates of the Cumberland Plateau in Tennessee. I have pleasure in saying that its working has been entirely satisfactory to me. On account of its excellent design and construction, I have thus far given it my preference over other Drills of its class with which I am familiar.

I take much interest in the signal success of your Underground Prospecting Drill, sizes "E" and "G." If I am not mistaken, the first Drill made for the special work that this style is designed for, was at my suggestion. * * * The first hole drilled was at the end of an ordinary sized drift, and in a horizontal direction, at a sharp angle to the inclined planes of stratification, to a depth of over two hundred feet, conditions purposely selected by me for a trial test of the Drill. The test was not only successfully made in ore, and in rock of widely varying degrees of hardness, from pure quartz to soft schist, but it gave especial satisfaction from the fact that the man operating the Drill was unskilled in diamond drilling, and ran the drill successfully after brief instructions from Mr. Ball, your Superintendent.

With certain changes made by your company, the principal of which was the addition of a friction disk to the differential feed, I had in the aggregate many hundred feet of holes bored with the Drill while I was in charge of the mines, at a cost per foot that was as surprising as it was gratifying to the company. This particular drill has saved to the company many times its cost, in expedition, and in far greater economy of the method over that of drift exploration, and it is still being used by the company in proving their ground.

While I would not knowingly under-estimate the drills of other makers, I can freely say that thus far I give yours the preference, not only on account of the excellent work they have done for me, but also because they are simple in design and strong in construction, economical in the use of steam or compressed air, and do all that you claim for them.

The promptness and skill with which you meet any special requirement, is an additional reason why I can cheerfully refer to you any parties desiring reliable drilling machinery.

Yours very truly, WM. H. CASE,
Permanent address, KNOXVILLE, TENN. *Mining Engineer and Contractor.*

"H" DRILL IN IOWA COAL FORMATIONS.

OTTUMWA & KIRKVILLE RAILWAY CO.
KIRKVILLE, Iowa, January 14, 1888.

Mr. F. K. Copeland, V. P. Diamond Prospecting Co., Chicago, Ill.

DEAR SIR: In reply to your inquiry of December 29th, in regard to the working of the "H" Diamond Steam Drill that we got from you, would say, that during the past nine months we drilled 7,675 feet, in fifty-two holes, at an average cost of 93⅓ cents per foot. Much of the drilling was through very rough material, and hence destructive to carbons. It was in a hilly country, and we had to haul fuel and water a considerable distance. The Drill has given perfect satisfaction, and not a single day was lost on account of any defect in it, and $25 would cover the cost of all repairs.

Very truly yours, H. L. WATERMAN, *Manager.*

———o———

SATISFACTORY WORKING OF "B" DRILL IN ALABAMA.

TUSKALOOSA COAL, IRON AND LAND COMPANY.
TUSKALOOSA, ALA., November 28, 1887.

The Diamond Prospecting Co., Chicago, Ill.

GENTLEMEN: In response to your inquiry as to how we are satisfied with the working of the DIAMOND DRILL recently purchased from you, would say that the Drill is satisfactory in every particular.

The rate of speed has been very good, most of the time in very hard formations, and we have reached a depth of more than a thousand feet without a break or hitch in the machine.

Yours truly, J. W. CASTLEMAN, *Secretary.*

———o———

ADVANTAGE OF A CORE DRILL.

SPARTA, TENN., April 20, 1887.

Mr. F. K. Copeland, Chicago, Ill.

DEAR SIR: * * * I am very much pleased at the working of the Drill, and don't see how we could have worked to an advantage without the knowledge of our mines which its core has given us. We are expecting coal every day. Yours truly,

J. M. OVERTON,
Manager Bon Air Coal Co.

———o———

"A" AND "G" IN COLORADO.

J. A. KEBLER, Gen. Manager.

COLORADO FUEL CO.
1657 Larimer St.
DENVER, COLO., January 22, 1889.

Diamond Prospecting Co., 74 and 76 W. Lake St., Chicago, Ill.

DEAR SIR: For the past three years we have used your Diamond Drills, under many varying and difficult conditions—in one case packing a "G" Drill several miles on mule back—and all sizes have given satisfaction in every instance. We have one of your "A" Drills in constant use, and expect soon to purchase another. Yours truly,

J. A. KEBLER,
Gen. Manager.

———o———

CONTRACT PROSPECTING.

ARTESIAN WELL DRILLING.

DENVER, COL., December 1, 1884.

Mr. F. K. Copeland, Secretary Diamond Prospecting Co., Chicago, Ill.

DEAR SIR: Your letter, relative to the work done by you with the SULLIVAN DIAMOND DRILL in sinking a well for Mr. L. C. Rockwell and myself on Grant Avenue last winter, duly received. During the progress of the work, I had occasion to watch the working of the Drill very closely, and was much pleased with it.

There were a number of difficulties to overcome in this well. In the first place, the drift deposit was very heavy—something over ninety feet, composed of a mixture of sand, gravel and bowlders; and at a depth of a little over three hundred feet, at the point where the first flow was reached, there was a formation that caved badly. In spite of these, however, the well was successfully sunk to a depth of six hundred and seventy-three feet, and cased with four-inch casing. The work was done to our entire satisfaction.

I am convinced that artesian wells can be sunk in a satisfactory manner with a SULLIVAN DIAMOND DRILL. Yours truly,

C. FERRIS.

SUPERINTENDENT'S OFFICE,
WHITEBREAST FUEL CO.
(Illinois Department.)
LADD, ILLINOIS, September 25, 1888.

Diamond Prospecting Co., Chicago, Ill.

GENTLEMEN: Regarding the accuracy of the record made in drilling for us with a SULLIVAN DIAMOND DRILL, would say, that we thoroughly tested the results obtained by your machine, by actually mining under a dozen holes, or more, drilled by you, and we have always found the reports furnished perfectly reliable, the widest variation having been an inch between the thickness of the coal reported by you and that proved by us by actual mining.

We have used the SULLIVAN DIAMOND DRILL for the past four years, and under all kinds of circumstances, and have found it rapid, accurate and satisfactory, and a reliable, efficient and speedy means for developing coal property.

We make this statement unqualifiedly, having had unusual opportunities for verifying the results obtained with this machine.

Yours truly,
T. J. PHILLIPS,
General Superintendent.

—o—

OFFICE OF
ELDON COAL AND MINING COMPANY,
OTTUMWA, IOWA, November 14, 1884.

To Whom it May Concern:

I have had the DIAMOND PROSPECTING COMPANY, of Chicago, to do a large amount of prospecting for me, and I take pleasure in recommending them as thoroughly honest and efficient.

O. M. LADD.

—o—

DOUGLAS COUNTY ROLLER MILLS,
J. B. WAMSLEY, Prop.
TUSCOLA, ILL., December 11, 1885.

To Whom it may Concern:

We, the undersigned, do hereby recommend the DIAMOND PROSPECTING CO., of Chicago, Illinois, for their ability and faithfulness in fulfilling, in every respect, their agreement and contract to prospect for coal at Tuscola, Illinois, to the depth of 1,000 feet, reaching the depth of 930 feet, and only stopping then by the order of the committee. We do further heartily recommend their work, it having been satisfactory in every particular.

J. B. WAMSLEY,
T. W. TYLER,
FRANK E. LOOSE,
JOHN L. GOFF,
JOS. J. KNOX. } Committee.

—o—

THE THAYER GAS AND MINING CO.
THAYER, KANSAS, January 1, 1887.

To Whom it may Concern:

On the 14th September, 1886, The Thayer Gas and Mining Co., of Thayer, Kansas, contracted with the DIAMOND PROSPECTING CO., of Chicago, Illinois, for sinking a test or prospect hole at this place. Work was promptly commenced and continued until a depth of 1,000 feet had been reached. Owing to the use of the most perfect working machinery, the employment of skilled mechanics, and the careful manner in which the work was performed, our company was enabled to procure a Core giving us fair and satisfactory information as to the strata through which the drill passed. We take pleasure in recommending the management of the DIAMOND PROSPECTING CO. as worthy of confidence.

Q. M. KELLOGG, *Sec'y.*

—o—

MT. VERNON, ILL., December 8, 1886.

We hereby certify that the DIAMOND PROSPECTING COMPANY, of Chicago, Illinois, which has been employed by the Citizens' Prospecting Committee, and afterwards by the city of Mt. Vernon, Ill., to prospect for coal, has done its work successfully, and to the satisfaction of all concerned. Its charges for work are reasonable, and its employes are noticeably gentlemanly and courteous in their dealings with the public.

S. H. WATSON,
L. F. M. WARD,
GEO. B. LEONARD. } *Prospecting Committee.*

M. M. GOODALE,
W. W. PRICE. } *Committee for the City.*

DIAMOND PROSPECTING CO.

GENERAL AGENTS,

74 & 76 WEST LAKE ST.

CABLE ADDRESS, "DIAMOND, CHICAGO." A B C CODE USED.

CHICAGO, ILL., U. S. A.

Sullivan Diamond Prospecting Core Drills,

FOR

SURFACE OR UNDERGROUND PROSPECTING,
SUBMARINE WORK, MINE VENTILATING AND DRAINAGE HOLES,
ENGINEERS' TESTS OF MASONRY, ETC.

DIAMOND POINTED AND STEEL QUARRYING MACHINERY,

INVALUABLE FOR

MARBLE, SLATE, SOAPSTONE, LIMESTONE AND SANDSTONE QUARRIES.

Hoisting and Hauling Engines and Machinery.

STATIONARY ENGINES, STEAM BOILERS, PUMPS.

VENTILATING FANS, CARS, CAGES.

UNDERGROUND HAULAGE BY WIRE ROPE A SPECIALTY.

ESTIMATES FURNISHED ON COMPLETE PLANTS.

Diamond Drill and General Mining Tools, Fixtures and Supplies.

CONTRACTORS FOR PROSPECTING MINERAL LANDS

WITH THE

SULLIVAN DIAMOND CORE DRILL.

SIMPSON & WATKINS,

AGENTS FOR PENNSYLVANIA,

SCRANTON, - - - PA.